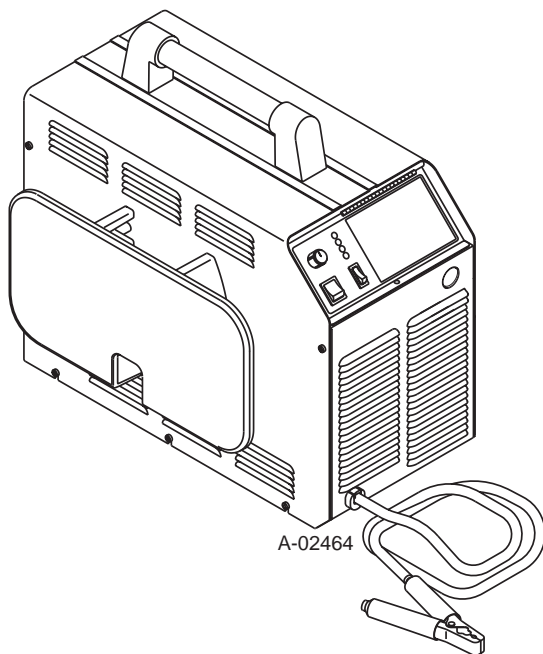


THERMAL DYNAMICS®
A THERMADYNE® Company

PakMaster™ 50 XL PLUS

Air Plasma Cutting Power Supply



Service Manual

August 12, 1999

Manual No. 0-2745

**WARNING**

Read and understand this entire Service Manual and your employer's safety practices before installing, operating, or servicing the equipment.

**WARNING**

While the information contained in this Service Manual represents our best judgement, Thermal Dynamics Corporation assumes no liability for its use.

Pak Master® 50XL PLUS Air Plasma Cutting Power Supply
Service Manual Number 0-2745

Published by:
Thermal Dynamics Corporation
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(603) 298-5711

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SECTION 1: GENERAL INFORMATION

1.01 Notes, Cautions and Warnings

Throughout this manual, notes, cautions, and warnings are used to highlight important information. These highlights are categorized as follows:

NOTE

An operation, procedure, or background information which requires additional emphasis or is helpful in efficient operation of the system.

CAUTION

A procedure which, if not properly followed, may cause damage to the equipment.



WARNING

A procedure which, if not properly followed, may cause injury to the operator or others in the operating area.

1.02 Important Safety Precautions



WARNINGS

OPERATION AND MAINTENANCE OF PLASMA ARC EQUIPMENT CAN BE DANGEROUS AND HAZARDOUS TO YOUR HEALTH.

Plasma arc cutting produces intense electric and magnetic emissions that may interfere with the proper function of cardiac pacemakers, hearing aids, or other electronic health equipment. Persons who work near plasma arc cutting applications should consult their medical health professional and the manufacturer of the health equipment to determine whether a hazard exists.

To prevent possible injury, read, understand and follow all warnings, safety precautions and instructions before using the equipment. Call 1-603-298-5711 or your local distributor if you have any questions.



GASES AND FUMES

Gases and fumes produced during the plasma cutting process can be dangerous and hazardous to your health.

- Keep all fumes and gases from the breathing area. Keep your head out of the welding fume plume.
- Use an air-supplied respirator if ventilation is not adequate to remove all fumes and gases.
- The kinds of fumes and gases from the plasma arc depend on the kind of metal being used, coatings on the metal, and the different processes. You must be very careful when cutting or welding any metals which may contain one or more of the following:

Antimony	Chromium	Mercury
Arsenic	Cobalt	Nickel
Barium	Copper	Selenium
Beryllium	Lead	Silver
Cadmium	Manganese	Vanadium

- Always read the Material Safety Data Sheets (MSDS) that should be supplied with the material you are using. These MSDSs will give you the information regarding the kind and amount of fumes and gases that may be dangerous to your health.
- For information on how to test for fumes and gases in your workplace, refer to item 1 in Subsection 1.03, Publications in this manual.
- Use special equipment, such as water or down draft cutting tables, to capture fumes and gases.
- Do not use the plasma torch in an area where combustible or explosive gases or materials are located.
- Phosgene, a toxic gas, is generated from the vapors of chlorinated solvents and cleansers. Remove all sources of these vapors.



ELECTRIC SHOCK

Electric Shock can injure or kill. The plasma arc process uses and produces high voltage electrical energy. This electric energy can cause severe or fatal shock to the operator or others in the workplace.

- Never touch any parts that are electrically "live" or "hot."
- Wear dry gloves and clothing. Insulate yourself from the work piece or other parts of the welding circuit.
- Repair or replace all worn or damaged parts.
- Extra care must be taken when the workplace is moist or damp.

- Install and maintain equipment according to NEC code, refer to item 9 in Subsection 1.03, Publications.
- Disconnect power source before performing any service or repairs.
- Read and follow all the instructions in the Operating Manual.



FIRE AND EXPLOSION

Fire and explosion can be caused by hot slag, sparks, or the plasma arc.

- Be sure there is no combustible or flammable material in the workplace. Any material that cannot be removed must be protected.
- Ventilate all flammable or explosive vapors from the workplace.
- Do not cut or weld on containers that may have held combustibles.
- Provide a fire watch when working in an area where fire hazards may exist.
- Hydrogen gas may be formed and trapped under aluminum workpieces when they are cut underwater or while using a water table. **DO NOT** cut aluminum alloys underwater or on a water table unless the hydrogen gas can be eliminated or dissipated. Trapped hydrogen gas that is ignited will cause an explosion.



NOISE

Noise can cause permanent hearing loss. Plasma arc processes can cause noise levels to exceed safe limits. You must protect your ears from loud noise to prevent permanent loss of hearing.

- To protect your hearing from loud noise, wear protective ear plugs and/or ear muffs. Protect others in the workplace.
- Noise levels should be measured to be sure the decibels (sound) do not exceed safe levels.
- For information on how to test for noise, see item 1 in Subsection 1.03, Publications, in this manual.



PLASMA ARC RAYS

Plasma Arc Rays can injure your eyes and burn your skin. The plasma arc process produces very bright ultra violet and infra red light. These arc rays will damage your eyes and burn your skin if you are not properly protected.

- To protect your eyes, always wear a welding helmet or shield. Also always wear safety glasses with side shields, goggles or other protective eye wear.
- Wear welding gloves and suitable clothing to protect your skin from the arc rays and sparks.
- Keep helmet and safety glasses in good condition. Replace lenses when cracked, chipped or dirty.
- Protect others in the work area from the arc rays. Use protective booths, screens or shields.
- Use the shade of lens as suggested in the following per ANSI/ASC Z49.1:

Arc Current	Minimum Protective Shade No.	Suggested Shade No.
Less Than 300*	8	9
300 - 400*	9	12
400 - 800*	10	14

** These values apply where the actual arc is clearly seen. Experience has shown that lighter filters may be used when the arc is hidden by the work-piece.*

1.03 Publications

Refer to the following standards or their latest revisions for more information:

1. OSHA, SAFETY AND HEALTH STANDARDS, 29CFR 1910, obtainable from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
2. ANSI Standard Z49.1, SAFETY IN WELDING AND CUTTING, obtainable from the American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126
3. NIOSH, SAFETY AND HEALTH IN ARC WELDING AND GAS WELDING AND CUTTING, obtainable from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
4. ANSI Standard Z87.1, SAFE PRACTICES FOR OCCUPATION AND EDUCATIONAL EYE AND FACE PROTECTION, obtainable from American National Standards Institute, 1430 Broadway, New York, NY 10018
5. ANSI Standard Z41.1, STANDARD FOR MEN'S SAFETY-TOE FOOTWEAR, obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018
6. ANSI Standard Z49.2, FIRE PREVENTION IN THE USE OF CUTTING AND WELDING PROCESSES, obtainable from American National Standards Institute, 1430 Broadway, New York, NY 10018
7. AWS Standard A6.0, WELDING AND CUTTING CONTAINERS WHICH HAVE HELD COMBUSTIBLES, obtainable from American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126

8. NFPA Standard 51, OXYGEN-FUEL GAS SYSTEMS FOR WELDING, CUTTING AND ALLIED PROCESSES, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
9. NFPA Standard 70, NATIONAL ELECTRICAL CODE, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
10. NFPA Standard 51B, CUTTING AND WELDING PROCESSES, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
11. CGA Pamphlet P-1, SAFE HANDLING OF COMPRESSED GASES IN CYLINDERS, obtainable from the Compressed Gas Association, 1235 Jefferson Davis Highway, Suite 501, Arlington, VA 22202
12. CSA Standard W117.2, CODE FOR SAFETY IN WELDING AND CUTTING, obtainable from the Canadian Standards Association, Standards Sales, 178 Rexdale Boulevard, Rexdale, Ontario, Canada M9W 1R3
13. NWSA booklet, WELDING SAFETY BIBLIOGRAPHY obtainable from the National Welding Supply Association, 1900 Arch Street, Philadelphia, PA 19103
14. American Welding Society Standard AWSF4.1, RECOMMENDED SAFE PRACTICES FOR THE PREPARATION FOR WELDING AND CUTTING OF CONTAINERS AND PIPING THAT HAVE HELD HAZARDOUS SUBSTANCES, obtainable from the American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126
15. ANSI Standard Z88.2, PRACTICE FOR RESPIRATORY PROTECTION, obtainable from American National Standards Institute, 1430 Broadway, New York, NY 10018

1.04 Note, Attention et Avertissement

Dans ce manuel, les mots “note,” “attention,” et “avertissement” sont utilisés pour mettre en relief des informations à caractère important. Ces mises en relief sont classifiées comme suit :

NOTE

Toute opération, procédure ou renseignement général sur lequel il importe d'insister davantage ou qui contribue à l'efficacité de fonctionnement du système.

ATTENTION

Toute procédure pouvant résulter l'endommagement du matériel en cas de non-respect de la procédure en question.



AVERTISSEMENT

Toute procédure pouvant provoquer des blessures de l'opérateur ou des autres personnes se trouvant dans la zone de travail en cas de non-respect de la procédure en question.

1.05 Precautions De Securite Importantes



AVERTISSEMENTS

L'OPÉRATION ET LA MAINTENANCE DU MATÉRIEL DE SOUDAGE À L'ARC AU JET DE PLASMA PEUVENT PRÉSENTER DES RISQUES ET DES DANGERS DE SANTÉ.

Coupant à l'arc au jet de plasma produit de l'énergie électrique haute tension et des émissions magnétique qui peuvent interférer la fonction propre d'un “pacemaker” cardiaque, les appareils auditif, ou autre matériel de santé électronique. Ceux qui travail près d'une application à l'arc au jet de plasma devrait consulter leur membre professionnel de médication et le manufacturier de matériel de santé pour déterminer s'il existe des risques de santé.

Il faut communiquer aux opérateurs et au personnel TOUS les dangers possibles. Afin d'éviter les blessures possibles, lisez, comprenez et suivez tous les avertissements, toutes les précautions de sécurité et toutes les consignes avant d'utiliser le matériel. Composez le + 603-298-5711 ou votre distributeur local si vous avez des questions.



FUMÉE et GAZ

La fumée et les gaz produits par le procédé de jet de plasma peuvent présenter des risques et des dangers de santé.

- Eloignez toute fumée et gaz de votre zone de respiration. Gardez votre tête hors de la plume de fumée provenant du chalumeau.
- Utilisez un appareil respiratoire à alimentation en air si l'aération fournie ne permet pas d'éliminer la fumée et les gaz.

- Les sortes de gaz et de fumée provenant de l'arc de plasma dépendent du genre de métal utilisé, des revêtements se trouvant sur le métal et des différents procédés. Vous devez prendre soin lorsque vous coupez ou soudez tout métal pouvant contenir un ou plusieurs des éléments suivants:

antimoine	cadmium	mercure
argent	chrome	nickel
arsenic	cobalt	plomb
baryum	cuiivre	sélénium
béryllium	manganèse	vanadium

- Lisez toujours les fiches de données sur la sécurité des matières (sigle américain "MSDS"); celles-ci devraient être fournies avec le matériel que vous utilisez. Les MSDS contiennent des renseignements quant à la quantité et la nature de la fumée et des gaz pouvant poser des dangers de santé.
- Pour des informations sur la manière de tester la fumée et les gaz de votre lieu de travail, consultez l'article 1 et les documents cités à la page 5.
- Utilisez un équipement spécial tel que des tables de coupe à débit d'eau ou à courant descendant pour capter la fumée et les gaz.
- N'utilisez pas le chalumeau au jet de plasma dans une zone où se trouvent des matières ou des gaz combustibles ou explosifs.
- Le phosgène, un gaz toxique, est généré par la fumée provenant des solvants et des produits de nettoyage chlorés. Éliminez toute source de telle fumée.



CHOC ELECTRIQUE

Les chocs électriques peuvent blesser ou même tuer. Le procédé au jet de plasma requiert et produit de l'énergie électrique haute tension. Cette énergie électrique peut produire des chocs graves, voire mortels, pour l'opérateur et les autres personnes sur le lieu de travail.

- Ne touchez jamais une pièce "sous tension" ou "vive"; portez des gants et des vêtements secs. Isolez-vous de la pièce de travail ou des autres parties du circuit de soudage.
- Réparez ou remplacez toute pièce usée ou endommagée.
- Prenez des soins particuliers lorsque la zone de travail est humide ou moite.
- Montez et maintenez le matériel conformément au Code électrique national des Etats-Unis. (Voir la page 5, article 9.)
- Débranchez l'alimentation électrique avant tout travail d'entretien ou de réparation.
- Lisez et respectez toutes les consignes du Manuel de consignes.



INCENDIE ET EXPLOSION

Les incendies et les explosions peuvent résulter des scories chaudes, des étincelles ou de l'arc de plasma. Le procédé à l'arc de plasma produit du métal, des étincelles, des scories chaudes pouvant mettre le feu aux matières combustibles ou provoquer l'explosion de fumées inflammables.

- Soyez certain qu'aucune matière combustible ou inflammable ne se trouve sur le lieu de travail. Protégez toute telle matière qu'il est impossible de retirer de la zone de travail.
- Procurez une bonne aération de toutes les fumées inflammables ou explosives.
- Ne coupez pas et ne soudez pas les conteneurs ayant pu renfermer des matières combustibles.
- Prévoyez une veille d'incendie lors de tout travail dans une zone présentant des dangers d'incendie.
- Le gas hydrogène peut se former ou s'accumuler sous les pièces de travail en aluminium lorsqu'elles sont coupées sous l'eau ou sur une table d'eau. NE PAS couper les alliages en aluminium sous l'eau ou sur une table d'eau à moins que le gas hydrogène peut s'échapper ou se dissiper. Le gas hydrogène accumulé explosera si enflammé.



RAYONS D'ARC DE PLASMA

Les rayons provenant de l'arc de plasma peuvent blesser vos yeux et brûler votre peau. Le procédé à l'arc de plasma produit une lumière infra-rouge et des rayons ultra-violets très forts. Ces rayons d'arc nuiront à vos yeux et brûleront votre peau si vous ne vous protégez pas correctement.

- Pour protéger vos yeux, portez toujours un casque ou un écran de soudeur. Portez toujours des lunettes de sécurité munies de parois latérales ou des lunettes de protection ou une autre sorte de protection oculaire.
- Portez des gants de soudeur et un vêtement protecteur approprié pour protéger votre peau contre les étincelles et les rayons de l'arc.
- Maintenez votre casque et vos lunettes de protection en bon état. Remplacez toute lentille sale ou comportant fissure ou rognure.
- Protégez les autres personnes se trouvant sur la zone de travail contre les rayons de l'arc en fournissant des cabines ou des écrans de protection.

- Utilisez la nuance de lentille qui est suggérée dans le recommandation qui suivent ANSI/ASC Z49.1:

Courant Arc	Nuance Minimum Protective Numéro	Nuance Suggestée Numéro
Moins de 300*	8	9
300 - 400*	9	12
400 - 800*	10	14

** Ces valeurs s'appliquent ou l'arc actuel est observé clairement. L'expérience a démontré que les filtres moins foncés peuvent être utilisés quand l'arc est caché par moiceau de travail.*



BRUIT

Le bruit peut provoquer une perte permanente de l'ouïe. Les procédés de soudage à l'arc de plasma peuvent provoquer des niveaux sonores supérieurs aux limites normalement acceptables. Vous devez vous protéger les oreilles contre les bruits forts afin d'éviter une perte permanente de l'ouïe.

- Pour protéger votre ouïe contre les bruits forts, portez des tampons protecteurs et/ou des protections auriculaires. Protégez également les autres personnes se trouvant sur le lieu de travail.
- Il faut mesurer les niveaux sonores afin d'assurer que les décibels (le bruit) ne dépassent pas les niveaux sûrs.
- Pour des renseignements sur la manière de tester le bruit, consultez l'article 1, page 5.

1.06 Documents De Reference

Consultez les normes suivantes ou les révisions les plus récentes ayant été faites à celles-ci pour de plus amples renseignements :

1. OSHA, NORMES DE SÉCURITÉ DU TRAVAIL ET DE PROTECTION DE LA SANTÉ, 29CFR 1910, disponible auprès du Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
2. Norme ANSI Z49.1, LA SÉCURITÉ DES OPÉRATIONS DE COUPE ET DE SOUDAGE, disponible auprès de la Société Américaine de Soudage (American Welding Society), 550 N.W. LeJeune Rd., Miami, FL 33126
3. NIOSH, LA SÉCURITÉ ET LA SANTÉ LORS DES OPÉRATIONS DE COUPE ET DE SOUDAGE À L'ARC ET AU GAZ, disponible auprès du Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402

4. Norme ANSI Z87.1, PRATIQUES SURES POUR LA PROTECTION DES YEUX ET DU VISAGE AU TRAVAIL ET DANS LES ECOLES, disponible de l'Institut Américain des Normes Nationales (American National Standards Institute), 1430 Broadway, New York, NY 10018
5. Norme ANSI Z41.1, NORMES POUR LES CHAUSSURES PROTECTRICES, disponible auprès de l'American National Standards Institute, 1430 Broadway, New York, NY 10018
6. Norme ANSI Z49.2, PRÉVENTION DES INCENDIES LORS DE L'EMPLOI DE PROCÉDÉS DE COUPE ET DE SOUDAGE, disponible auprès de l'American National Standards Institute, 1430 Broadway, New York, NY 10018
7. Norme A6.0 de l'Association Américaine du Soudage (AWS), LE SOUDAGE ET LA COUPE DE CONTENEURS AYANT RENFERMÉ DES PRODUITS COMBUSTIBLES, disponible auprès de la American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126
8. Norme 51 de l'Association Américaine pour la Protection contre les Incendies (NFPA), LES SYSTEMES À GAZ AVEC ALIMENTATION EN OXYGENE POUR LE SOUDAGE, LA COUPE ET LES PROCÉDÉS ASSOCIÉS, disponible auprès de la National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
9. Norme 70 de la NFPA, CODE ELECTRIQUE NATIONAL, disponible auprès de la National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
10. Norme 51B de la NFPA, LES PROCÉDÉS DE COUPE ET DE SOUDAGE, disponible auprès de la National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
11. Brochure GCA P-1, LA MANIPULATION SANS RISQUE DES GAZ COMPRIMÉS EN CYLINDRES, disponible auprès de l'Association des Gaz Comprimés (Compressed Gas Association), 1235 Jefferson Davis Highway, Suite 501, Arlington, VA 22202
12. Norme CSA W117.2, CODE DE SÉCURITÉ POUR LE SOUDAGE ET LA COUPE, disponible auprès de l'Association des Normes Canadiennes, Standards Sales, 178 Rexdale Boulevard, Rexdale, Ontario, Canada, M9W 1R3
13. ivret NWSA, BIBLIOGRAPHIE SUR LA SÉCURITÉ DU SOUDAGE, disponible auprès de l'Association Nationale de Fournitures de Soudage (National Welding Supply Association), 1900 Arch Street, Philadelphia, PA 19103

14. Norme AWSF4.1 de l'Association Américaine de Soudage, RECOMMANDATIONS DE PRATIQUES SURES POUR LA PRÉPARATION À LA COUPE ET AU SOUDAGE DE CONTENEURS ET TUYAUX AYANT RENFERMÉ DES PRODUITS DANGEREUX, disponible auprès de la American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126
15. Norme ANSI Z88.2, PRATIQUES DE PROTECTION RESPIRATOIRE, disponible auprès de l'American National Standards Institute, 1430 Broadway, New York, NY 10018

1.07 Declaration of Conformity

Manufacturer: Thermal Dynamics Corporation
Address: Industrial Park #2
West Lebanon, New Hampshire 03784
USA

The equipment described in this manual conforms to all applicable aspects and regulations of the 'Low Voltage Directive' (European Council Directive 73/23/EEC as amended by Council Directive 93/68/EEC) and to the National legislation for the enforcement of this Directive.

Serial numbers are unique with each individual piece of equipment and details description, parts used to manufacture a unit and date of manufacture.

National Standard and Technical Specifications

The product is designed and manufactured to a number of standards and technical requirements among them are:

- * CSA (Canadian Standards Association) standard C22.2 number 60 for Arc welding equipment.
- * UL (Underwriters Laboratory) rating 94VO flammability testing for all printed-circuit boards used.
- * ISO/IEC 60974-1 (BS 638-PT10) (EN 60 974-1) (EN50192) (EN50078) applicable to plasma cutting equipment and associated accessories.
- * Extensive product design verification is conducted at the manufacturing facility as part of the routine design and manufacturing process. This is to ensure the product is safe, when used according to instructions in this manual and related industry standards, and performs as specified. Rigorous testing is incorporated into the manufacturing process to ensure the manufactured product meets or exceeds all design specifications.

Thermal Dynamics has been manufacturing products for more than 30 years, and will continue to achieve excellence in our area of manufacture.

Manufacturers responsible representative: Steve Ward
Director of Operations
Thermadyne UK
Chorley England

1.08 Statement of Warranty

LIMITED WARRANTY: Thermal Dynamics® Corporation (hereinafter "Thermal") warrants that its products will be free of defects in workmanship or material. Should any failure to conform to this warranty appear within the time period applicable to the Thermal products as stated below, Thermal shall, upon notification thereof and substantiation that the product has been stored, installed, operated, and maintained in accordance with Thermal's specifications, instructions, recommendations and recognized standard industry practice, and not subject to misuse, repair, neglect, alteration, or accident, correct such defects by suitable repair or replacement, at Thermal's sole option, of any components or parts of the product determined by Thermal to be defective.

THIS WARRANTY IS EXCLUSIVE AND IS IN LIEU OF ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

LIMITATION OF LIABILITY: Thermal shall not under any circumstances be liable for special or consequential damages, such as, but not limited to, damage or loss of purchased or replacement goods, or claims of customers of distributor (hereinafter "Purchaser") for service interruption. The remedies of the Purchaser set forth herein are exclusive and the liability of Thermal with respect to any contract, or anything done in connection therewith such as the performance or breach thereof, or from the manufacture, sale, delivery, resale, or use of any goods covered by or furnished by Thermal whether arising out of contract, negligence, strict tort, or under any warranty, or otherwise, shall not, except as expressly provided herein, exceed the price of the goods upon which such liability is based.

THIS WARRANTY BECOMES INVALID IF REPLACEMENT PARTS OR ACCESSORIES ARE USED WHICH MAY IMPAIR THE SAFETY OR PERFORMANCE OF ANY THERMAL PRODUCT.

THIS WARRANTY IS INVALID IF THE PRODUCT IS SOLD BY NON-AUTHORIZED PERSONS.

The limited warranty periods for Thermal products shall be as follows (with the exception of XL Plus Series, CutMaster 80XL, Cougar and DRAG-GUN): A maximum of three (3) years from date of sale to an authorized distributor and a maximum of two (2) years from date of sale by such distributor to the Purchaser, and with the further limitations on such two (2) year period (see chart below).

The limited warranty period for XL Plus Series and CutMaster 80XL shall be as follows: A maximum of four (4) years from date of sale to an authorized distributor and a maximum of three (3) years from date of sale by such distributor to the Purchaser, and with the further limitations on such three (3) year period (see chart below).

The limited warranty period for Cougar and DRAG-GUN shall be as follows: A maximum of two (2) years from date of sale to an authorized distributor and a maximum of one (1) year from date of sale by such distributor to the Purchaser, and with the further limitations on such two (2) year period (see chart below).

	Parts			
	<u>XL Plus Series & CutMaster 80XL</u>	<u>Parts Cougar/Drag-Gun</u>	<u>Parts All Others</u>	<u>Labor</u>
<u>PAK Units, Power Supplies</u>				
Main Power Magnetics	3 Years	1 Year	2 Years	1 Year
Original Main Power Rectifier	3 Years	1 Year	2 Years	1 Year
Control PC Board	3 Years	1 Year	2 Years	1 Year
All Other Circuits And Components Including, But Not Limited To, Starting Circuit, Contactors, Relays, Solenoids, Pumps, Power Switching Semi-Conductors	1 Year	1 Year	1 Year	1 Year
<u>Consoles, Control Equipment, Heat Exchanges, And Accessory Equipment</u>	1 Year		1 Year	1 Year
<u>Torch And Leads</u>				
Maximizer 300 Torch			1 Year	1 Year
All Other Torches	180 Days	180 Days	180 Days	180 Days
<u>Repair/Replacement Parts</u>	90 Days	90 Days	90 Days	None

Warranty repairs or replacement claims under this limited warranty must be submitted by an authorized Thermal Dynamics® repair facility within thirty (30) days of the repair. No transportation costs of any kind will be paid under this warranty. Transportation charges to send products to an authorized warranty repair facility shall be the responsibility of the customer. All returned goods shall be at the customer's risk and expense. This warranty supersedes all previous Thermal warranties.

Effective May 6, 1999

SECTION 2: INTRODUCTION

2.01 Scope Of Manual

This manual provides service instructions for Thermal Dynamics PAK Master® 50XL PLUS Air Plasma Power Supply.

Refer to Operating Manual (0-2744) for individual operating procedures. Information in this edition is therefore particularly applicable to the Troubleshooting and Repair of the equipment, and is intended for use by properly-trained Service Technicians familiar with this equipment.

Read this Manual and the Operating Manual, 0-2744, thoroughly. A complete understanding of the capabilities and functions of the equipment will assure obtaining the performance for which it was designed.

2.02 General Service Philosophy

Several key points are essential to properly support the application and operation of this equipment.

A. Application

The equipment should satisfy the customer's requirements as supplied and as described in Section 3 of this manual. Be sure to confirm that the equipment is capable of the application desired.

B. Modifications

No physical or electrical modifications other than selection of standard options and Accessories are to be made to this equipment.

C. Customer/Operator Responsibilities

It is the customer/operator's responsibility to maintain the equipment and peripheral accessories provided by Thermal Dynamics in good operating order in accordance with the procedures outlined in the Operating Manual, and to protect the equipment from accidental or malicious damage.

D. Repair Restrictions

The electronics consists of Printed Circuit Board Assemblies which must be carefully handled, and must be replaced as units. No replacement of printed circuit solder-mounted components is allowed except as noted in this manual.

If to be returned, the replaced Printed Circuit Board Assemblies must be properly packaged in protective material and returned intact per normal procedures.

2.03 Service Responsibilities

The Service Technician should be familiar with the equipment and its capabilities and should be prepared to recommend arrangements of components which will provide the most efficient layout, utilizing the equipment to its best possible advantage.

Maintenance work should be accomplished in a timely manner. If problems are encountered, or the equipment does not function as specified, contact the Technical Services Department at West Lebanon for assistance.

SECTION 3: DESCRIPTION

3.01 Scope

The information in this section has two purposes:

- To familiarize the service technician with the capabilities and limitations of the equipment,
- To provide an overall understanding which will allow the technician, in turn, to properly train customer's operating personnel.

3.02 General Description

The power supply provides 40 amp maximum output and includes all control circuitry, electrical and gas inputs and outputs, pilot circuitry, torch leads receptacle and a work cable with clamp. 208/230/240V single-phase units also include a 50 amp input cable and plug.

NOTE

The power supply can be ordered in various configurations with various options factory installed.

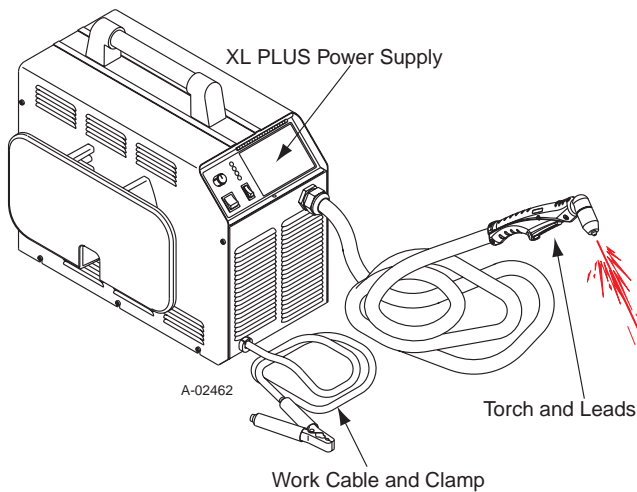


Figure 2-1 Pak Master 50XL PLUS Power Supply

The power supply is designed to work with the Model PCH/M-40 Plasma Torches.

Torches will provide a maximum 1/2 inch (12.7 mm) cut capacity. Hand torches are available in both 70° and 90° configurations. Machine torches are available in a 180° configuration. Torch leads are available in 25 ft (7.6 m), or 50 ft (15.2 m) lengths with fittings for simple installation. Spare Parts Kits which provide an assortment of replacement torch parts are available for the torches.

NOTE

Refer to Section 3.04 for list of power supply options and accessories.

3.03 Specifications/Design Features

A. Power Supply Technical Specifications

The following specifications apply to the Power Supply only:

1. Front Panel Controls

ON/OFF Switch, RUN/SET/LATCH Switch and Output Current Control

2. Front Panel LED Indicators

AC, TEMP, GAS, DC

3. Rear Panel

Input Power Cable*, Gas Connection, Gas Regulator/Filter Assembly

*208/230/240V single-phase units include a 50 amp input cable and plug.

4. Input Power

Available for the following input power:

208/230/240 VAC ($\pm 10\%$), 50/60 Hz, Single or Three-Phase

380/415 VAC ($\pm 10\%$), 50/60 Hz, Three-Phase

460 VAC ($\pm 10\%$), 50/60 Hz, Single or Three-Phase

(575 VAC can be utilized with the addition of the optional transformer unit).

5. Output Power

Continuously variable from 15 to 40 Amps maximum

6. Duty Cycle

100% duty cycle at 40 Amps

7. Cut Capacity

1/2 inch (12.7 mm); 3/4 inch (19 mm) severance

8. Pilot Circuitry

Capacitive Discharge (CD), Pulsed DC

9. Weight

62 lbs (28 kg) w/work lead only

66 lbs (30 kg) w/work lead and torch & lead

10. Overall Dimensions

Overall dimensions are with Handle, Lead Wrap Bracket, and Gas Regulator/Filter Assembly installed.

19" (482 mm) High x 13" (330 mm) Wide x 24.8" (63 m) Long

B. Gas Regulator/Filter Assembly Specifications

The following specifications apply to the Gas Regulator/Filter Assembly only:

1. Gas regulator maximum gauge pressure

160 psi (11 bar)

2. Maximum input gas pressure

125 psi (8.6 bar)

3. Filter

Coalescent type filter

3.04 Power Supply Options and Accessories

NOTE

Refer to Section 6, Parts Lists, for part numbers and ordering information.

The following are some of the accessories that are available for this power supply. Refer to Section 6.09 for a complete list:

A. Dry Air In-Line Filter Kit

An optional in line filter for use on compressed air shop systems. Highly effective at removing moisture and particulate matter from the air stream to at least .85 microns.

B. Two Stage Air Line Filter

An alternative to the Dry Air Filter, this optional two stage air line filter is for use on compressed air shop systems. The filter will remove moisture and contaminants from the air stream to at least 5.0 microns. The filter assembly is pre-assembled at the factory and need only be attached to the power supply.

C. High Pressure Regulators

High pressure regulators are available for air and nitrogen. The regulators are used to set the proper pressure for the type gas being used.

D. Smart Cart

Steel cart on easy rolling 10" pneumatic tires to provide maximum mobility for the power supply. Handle is 3/4" tubing with hooks for storage of torch leads. A tie down strap is also included.

E. 575V Transformer

This step-down transformer allows the power supply to operate with 575 VAC three-phase input power.

F. Computer Control Cable (CNC)

NOTE

This accessory is for use with PCM-40 Torches only.

This interface cable is available in two lengths, 25 ft (7.6 m) and 50 ft (15.2 m). The cable is used to interface the power supply with an auxiliary control device to provide OK-To-Move and ON/OFF signals.

G. Cutting Guide Kit

Easy add-on attachments to allow for straight line, circle, or bevel cutting.

H. Hand Pendant Control

A hand pendant control with 25 ft (7.6m) cable which provides ON/OFF signals to the power supply.

Also offered is a 25 ft (7.6m) extension cable which can be added to the hand Pendant Control cable to provide a total length of 50 ft (15.2m).

SECTION 4: SERVICE TROUBLESHOOTING DIAGNOSTICS

4.01 Introduction

This section provides service diagnostics for the Pak Master 50XL PLUS Power Supply, allowing the Technician to isolate any faulty subassemblies. Refer to Section 5, Repairs & Replacement Procedures, for parts replacement instructions.

Under no circumstances are field repairs to be attempted on Printed Circuit Boards or other subassemblies of this unit. Evidence of unauthorized repairs will void the factory warranty.

NOTE

The troubleshooting contained in this manual is for the Power Supply only. Troubleshooting other parts of the system is covered in the separate manuals for those products.

4.02 Periodic Inspection & Procedures

This subsection describes inspection procedures which should be performed at periodic intervals as required.

A. Physical Inspection

Check that all cable connections are secure.

B. Cleaning

Unit should be cleaned and maintained as described in Operating Manual 0-2744.

4.03 Common Operating Problems



WARNINGS

Disconnect primary power at the source before disassembling the power supply, torch, or torch leads.

Frequently review the Important Safety Precautions (page 1). Be sure the operator is equipped with proper gloves, clothing, eye and ear protection. Make sure no part of the operator's body comes into contact with the workpiece while the torch is activated.

CAUTION

Sparks from the cutting process can cause damage to coated, painted, and other surfaces such as glass, plastic and metal.

NOTE

Handle torch leads with care and protect them from damage.

A. Piloting

Piloting is harder on parts life than actual cutting because the pilot arc is directed from the electrode to the tip rather than to a workpiece. Whenever possible, avoid excessive pilot arc time to improve parts life.

B. Torch Standoff

Improper standoff (the distance between the torch tip and workpiece) can adversely affect tip life as well as shield cup life. Standoff may also significantly affect the bevel angle. Reducing standoff generally results in a more square cut.

C. Edge Starting

For edge starts, hold the torch perpendicular to the workpiece with the front of the torch tip at the edge of the workpiece, not touching, at the point where the cut is to start. When starting at the edge of the plate, do not pause at the edge and force the arc to "reach" for the edge of the metal. Establish the cutting arc as quickly as possible.

D. Direction of Cut

The plasma gas stream swirls as it leaves the torch. The purpose of the swirl is to maintain a smooth column of gas. The swirl effect results in one side of a cut being more square than the other. Viewed along the direction of travel, the right side of the cut is more square than the left.

E. Dross

When dross is present on carbon steel, it is commonly referred to as either "high speed, slow speed, or top dross". Dross present on top of the plate is normally caused by too great a torch to plate distance. "Top dross" is normally very easy to remove and can often be wiped off with a welding glove. "Slow speed dross" is normally present on the bottom edge of the plate. It can vary from a light to heavy bead, but does not adhere tightly to the cut edge, and can be easily scraped off. "High speed dross" usually forms a narrow bead along the bottom of the cut edge and is very difficult to remove. When cutting a troublesome steel,

it is sometimes useful to reduce the cutting speed to produce "slow speed dross". Any resultant cleanup can be accomplished by scraping, not grinding.

F. Common Cutting Faults

1. Insufficient Penetration

- a. *Cutting speed too fast*
- b. *Torch tilted too much*
- c. *Metal too thick*
- d. *Worn torch parts*
- e. *Cutting current too low*

2. Main Arc Extinguishes

- a. *Cutting speed too slow*
- b. *Torch standoff too high from workpiece*
- c. *Cutting current too high*
- d. *Work cable disconnected*
- e. *Worn torch parts*

3. Excessive Dross Formation

- a. *Cutting speed too slow*
- b. *Torch standoff too high from workpiece*
- c. *Worn torch parts*
- d. *Improper cutting current*

4. Short Torch Parts Life

- a. *Moisture in air source*
- b. *Exceeding system capability (material too thick)*
- c. *Excessive pilot arc time*
- d. *Air flow too low (incorrect pressure)*
- e. *Improperly assembled torch*
- f. *Incorrect torch parts for the operation*
- g. *Non-Genuine Thermal Dynamics parts used*

4.04 Troubleshooting Guide - General Information



WARNING

There are extremely dangerous voltage and power levels present inside this unit. Do not attempt to diagnose or repair unless you have had training in power electronics measurement and troubleshooting techniques.

A. Troubleshooting and Repair

Troubleshooting and repair of this unit is a process which should be undertaken only by those familiar with high voltage high power electronic equipment.

B. Advanced Troubleshooting



NOTE

For basic troubleshooting and parts replacement procedures refer to Pak Master 50XL PLUS Operating Manual 0-2744.

The advanced troubleshooting covered in this Service Manual requires Power Supply disassembly and live measurements. It is helpful for solving many of the common problems that can arise with the Pak Master 50XL PLUS Power Supply.

If major complex subassemblies are faulty, the faulty sub-assembly must be returned for repair.

NOTE

Follow all instructions as listed and complete each in the order presented.

Subsection 4.09 includes specific test procedures and LED status identification tables. The subsection is referenced by the troubleshooting guide for the specific test to be performed.

The troubleshooting guide has six subsections as follows:

Section 4.05 - Circuit Fault Isolation

Section 4.06 - Main Input and Internal Power Problems

Section 4.07 - Pilot Arc Problems

Section 4.08 - Main Arc Problems

Section 4.09 - Test Procedures

C. How to Use the Troubleshooting Guide

The following information is a guide to help the Service Technician determine the most likely causes for various symptoms. This guide is set up in the following manner:

1. Perform operational check(s) on the equipment to isolate problem to possible circuit(s) per Section 4.05, Circuit Fault Isolation.
2. Determine symptom and isolate to defective assembly using the following format:

X. Symptom (Bold Type)

Any Special Instructions (Text Type)

1. Cause (*Italic Type*)

- a. Check/Remedy (Text Type)

3. Locate your **symptom** in the appropriate Sub-Section.
4. Check the *causes* (easiest listed first) for the **symptom**.
5. Check the remedies listed for each cause.
6. Repair as needed being sure to verify that unit is fully operational after any repairs.

NOTES

*Many signals are transferred between Printed Circuit Board Assemblies on Ribbon Cables. If these cables become faulty they can then cause various problems. **Do not** forget about these cables when troubleshooting.*

While troubleshooting visually inspect the internal components for signs of over heating, fractures and damage.

4.05 Circuit Fault Isolation

NOTE

Follow all instructions as listed and complete each in the order presented.

This section is to help isolate the defective circuit before troubleshooting, identify symptoms, and test the unit for proper operation. Follow the instructions as given to identify the possible symptom(s) and the defective circuit. After repairs are complete then run the following tests again to verify that the unit is fully operational.

A. Initial Setup Conditions

1. Connect gas supply to rear of Power Supply.
2. Turn on gas supply and adjust Power Supply Gas Regulator to 70 psi (4.8 bar)

3. Set the Power Supply controls as follows:

ON/OFF switch to OFF

RUN/SET/LATCH switch to SET

CURRENT control potentiometer to maximum

B. Main Input and Internal Power Tests

1. Connect main AC power to the unit.
2. Set the Power Supply ON/OFF switch to ON and note the following:
 - AC indicator blinks for six seconds, then steady ON
 - Relay K10 on Input PC Board energizes (clicks) while AC indicator is blinking
 - K11 Relay energizes pulling in MC1 after AC light stops blinking.
 - TEMP indicator OFF
 - GAS indicator ON
 - Gas flows
 - Fans will operate
 - DC Indicator is OFF
3. Set the Power Supply RUN/SET/LATCH switch to the RUN position and note the following:
 - Gas indicator goes OFF
 - Gas flow stops

This completes the Main Input and Internal Power Tests. If the above are all correct then proceed to paragraph 'C'.

If the above does not function as noted then note the symptom and proceed to Section 4.06, Main Input and Internal Power Problems.

C. Pilot Arc Test

1. Press the torch switch to establish a pilot arc and note the following:
 - Gas flows
 - GAS indicator turns ON
 - After preflow delay DC indicator turns ON
 - Pilot arc established

This completes the Pilot Arc Test. If the above are all correct then proceed to paragraph 'D'.

If the above does not function as noted then note the symptom and proceed to Section 4.07, Pilot Arc Problems.

D. Main Arc Test

Press the Torch Switch to establish a pilot arc.

Bring the torch to within 1/8"-3/8" (3.2 - 9.5 mm) of the workpiece to establish the main cutting arc, and note the following:

- Main cutting arc initiates
- Pilot Relay opens

This completes the Main Arc Test. If the above are all correct then the equipment should be operating properly. If problems still persist then contact Technical Services.

If the above does not function as noted then note the symptom and proceed to Section 4.08, Main Arc Problems.

4.06 Main Input and Internal Power Problems

Locate your symptom below:

A. Main power line fuses blow as soon as main disconnect is closed

1. *Input power cable installed incorrectly*
 - a. Refer to Operating Manual 0-2744, Section 3.07 and connect primary input power cable.
2. *Input voltage selection incorrect for the main input voltage*
 - a. Refer to Operating Manual 0-2744, Section 3.06 and select proper input voltage

B. Main power line fuses blow 3-6 seconds after the ON/OFF Switch is turned on.

1. *Faulty Input PC Board and Rectifier*
 - a. Test Input PC Board/Rectifier per Section 4.09-D; repair as necessary
2. *Faulty FET PC Board*
 - a. Test FET PC Board per Section 4.09-I; repair as necessary

C. AC indicator on front panel of power supply is OFF; Fan does not operate

1. *Front Panel ON/OFF switch in OFF position*
 - a. Place switch to ON position
2. *Main power disconnect not closed*
 - a. Close main power disconnect
3. *Main power line fuses blown*

- a. Replace main power line Fuses

4. *Defective input power cable*

- a. Replace input power cable

5. *Improper input power line connections inside Power Supply*

- a. Refer to Operating Manual 0-2744, Section 3.07 and correct if needed

6. *Fuse blown inside Power Supply*

- a. Replace internal Fuse (1 FU)

7. *Line voltage above 10% tolerance (over voltage protection)*

- a. Reduce line supply.

8. *Voltage selection plug connected incorrectly*

- a. Refer to Operating Manual 0-2744, Section 3.06 and correct as needed

9. *Faulty Auxiliary Transformer (refer to Appendix X, 36 VAC Circuit Diagram)*

Measure for 36 VAC on Logic/Gate PC Board from J1-1 to J1-5.

- a. If voltage is not present, replace the Auxiliary Transformer.

10. *Faulty Logic/Gate PC Board (refer to Appendix X, 36 VAC Circuit Diagram).*

Measure for 36 VAC on Logic/Gate PC Board from J3-1 to J3-3.

- a. If voltage is not present, replace the Logic/Gate PC Board.

11. *Faulty ON/OFF switch (refer to Appendix X, 36 VAC Circuit Diagram).*

Measure for 36vac on the Logic/Gate PC Board between J3-2 to J3-4.

- a. If voltage is not present replace the ON/OFF switch
- b. If voltage is present, replace Logic/Gate PCB.

D. AC indicator ON, TEMP indicator ON, System will not pilot

1. *Air flow through unit is restricted*

- a. Provide adequate air flow (Refer to Operating Manual 0-2744, Section 3.02)

2. *Exceeded duty cycle of Power Supply*

- a. Wait for fans to cool unit and refer to Operating Manual 0-2744, Section 2.03, for proper Duty Cycle

3. Faulty Fan or Logic/Gate PC Board

Measure for 115 VAC on the Logic/Gate PC Board from J2-2 to J2-8 and J2-3 to J2-9.

- If voltage is correct, replace Fan Assembly
- If voltage is incorrect, replace Logic/Gate PC Board

4. Faulty temperature circuit

- a. Check temperature circuit per Section 4.09-F; repair as necessary

E. AC indicator ON; TEMP indicator OFF; No gas flow; GAS and DC indicators OFF

1. RUN/SET/LATCH switch in RUN(or LATCH) position

- a. Switch to SET position

2. Gas supply not connected to unit

- a. Connect to gas supply.

3. Gas supply not turned on

- a. Turn gas supply on.

4. Gas supply inlet pressure too high

- a. Set gas supply inlet pressure between 100-110 PSI.

5. Faulty RUN/SET/LATCH switch

- a. Check continuity.

6. Faulty gas solenoid circuit

- a. Test gas solenoid circuit per Section 4.09-G; repair as necessary.

F. AC indicator ON; GAS indicator OFF; Gas flows; DC indicator OFF

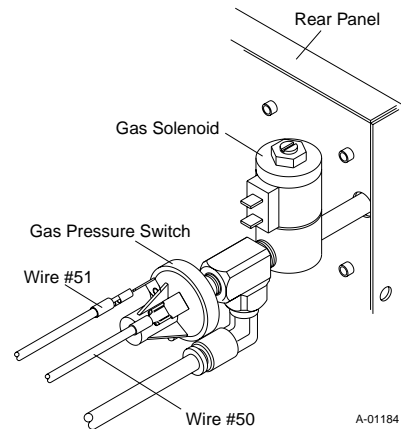
1. Gas pressure too low

- a. See torch manual for operating pressures

2. Faulty pressure switch

Measure for DC voltage from wire #51 to wire #50 at the gas pressure switch at the rear of the Rear Panel Assembly.

- a. If 12vdc and pressure is above 50 PSI, replace gas pressure switch.

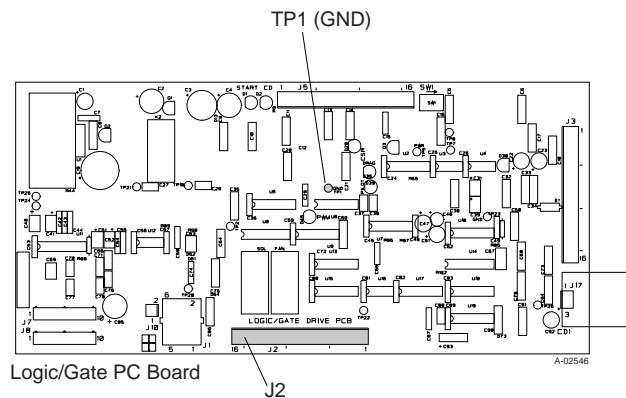


5. Faulty Wiring or Logic/Gate PC Board

Check for DC voltage from Logic/Gate PC Board J2-13 to TP1 (GND)

- If less than a volt, replace Logic/Gate PC Board

If 12 VDC check wiring to PS1.



G. AC indicator ON; Gas flows; GAS and DC indicators ON; Arc in torch without pressing torch switch

1. Faulty torch switch

- a. Refer to appropriate Torch Instruction Manual and check continuity

2. Faulty torch leads

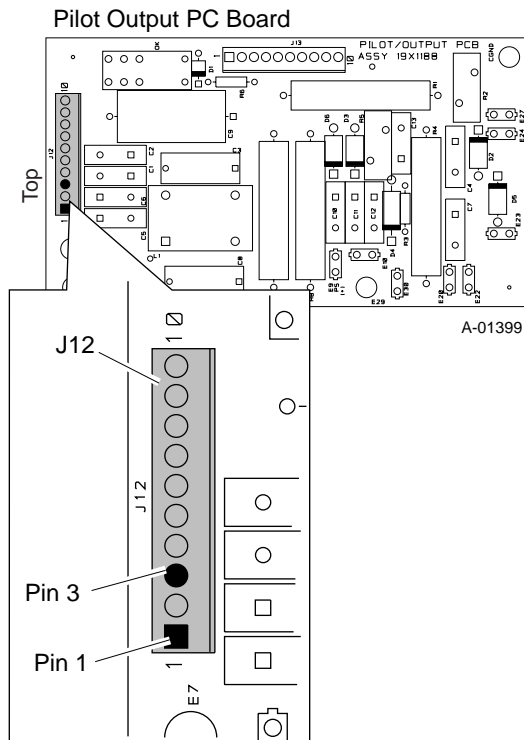
- a. Refer to appropriate Torch Instruction Manual and check continuity

3. Faulty Pilot Output PC Board

Remove power from the power supply. Disconnect J12 and J13 from the Pilot PC Board.

Check for an open between J12 pin 1 to J12 pin 3 on the Pilot Output PC Board.

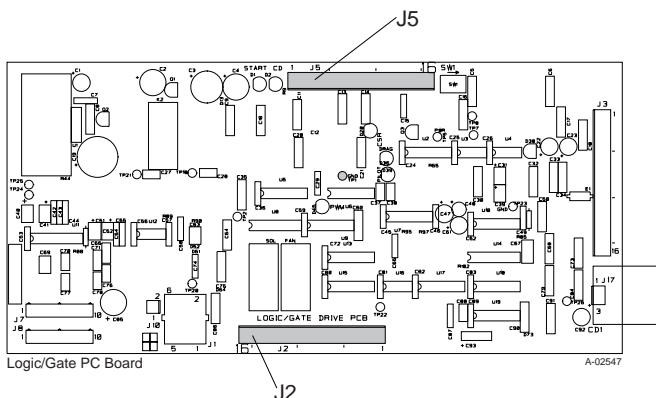
- a. Replace Pilot Output PC Board if reading is not open.



4. Faulty Logic/Gate or Pilot PC Board

Check for DC voltage from Logic/Gate PC Board J5 pin 8 to J5 pin 9.

- a. Replace Logic/Gate PC Board if voltage is 12VDC.



4.07 Pilot Arc Problems

Locate your symptom below:

A. AC indicator ON; TEMP indicator off; No gas flow; GAS and DC indicators OFF (Torch Switch must be pressed)

1. Faulty hand torch parts or Logic/Gate PC Board

Check start indicator, D1, on the Logic/Gate PC Board.

- a. If start indicator D1 is ON, replace Logic/Gate PCB.
- b. If start indicator D1 on Logic/Gate PC Board is OFF check the following:

Check Pilot/Output PC Board for 12 VDC between J12 pin 1 to pin 3 with torch switch pressed.

- If voltage is correct, check Torch Switch and PIP as needed per appropriate torch manual.
- If voltage is incorrect, replace Logic/Gate PC Board

2. Faulty Logic/Gate PC Board

Measure for 12VDC on Logic/Gate PC Board between J5-8 and J5-9.

If voltage is less than 2VDC, replace Logic/Gate PC Board.

B. AC indicator ON; TEMP indicator off; Gas flows; GAS indicator ON; DC indicator blinks; Small arc may be visible in torch

1. Faulty Pilot Output PC Board or Shorted Torch

- a. Test per Section 4.09-H; repair as necessary

2. Faulty FET/Heatsink Assembly

- a. Check per Section 4.09-I; repair as necessary

3. Faulty torch

- a. Check torch per appropriate Torch Instruction Manual

C. AC indicator ON; TEMP indicator off; Gas flows; GAS and DC indicators ON; No arc in torch; No arc at spark gap on CD PC Board; CD enable indicator (D2) ON

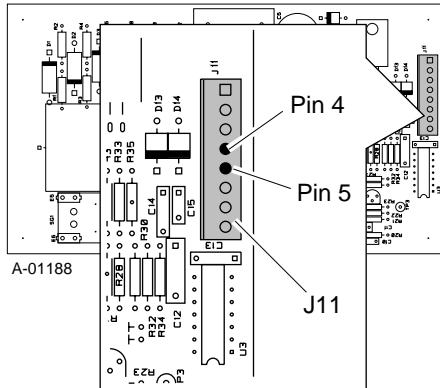
1. Faulty CD PC Board

Measure for 36VAC between J11-1 and J11-3.

Measure DC voltage between J11-4 to J11-5 on CD PC Board.

- a. If voltage is less than 2VDC replace CD PC Board.

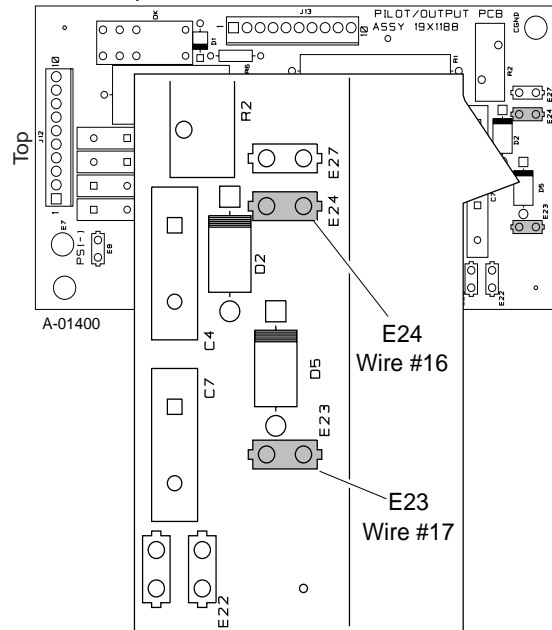
CD PC Board



D. AC indicator ON; TEMP indicator off; Gas flows; GAS and DC indicators ON; Spark at gap on CD PC Board and CD enable indicator (D2) on Logic/Gate PC Board ON; No arc or intermittent arc in torch

1. Gas pressure(s) set incorrectly (too high)
 - a. Refer to appropriate Torch Manual
2. Oil/moisture in air lines
 - a. Purge system. If problem corrected add filters in line with air source
3. Incorrect torch parts
 - a. Refer to appropriate Torch Instruction Manual
4. Faulty leads
 - a. Check continuity per appropriate Torch Instruction Manual
5. Faulty torch
 - a. Check continuity per appropriate Torch Instruction Manual
6. Faulty connection of wire #16 or #17 to Pilot Output PC Board
 - a. Check wiring connection

Pilot Output PC Board



7. Faulty Logic/Gate PC Board

Check D39 & D2 on the Logic/Gate PC Board

- a. If D39 & D2 are not on, replace Logic/Gate Board.

Measure for 12 vdc on Logic/Gate PC Board from J5-6 to J5-7.

- a. If voltage is low, then replace Logic/Gate PC Board.

8. Faulty PCR Relay

Install a jumper between wires #12 and #14. Retry piloting again.

- a. If torch pilots with jumper installed, replace PCR Relay

4.08 Main Arc Problems

Locate your symptom below:

A. Main cutting arc will not initiate

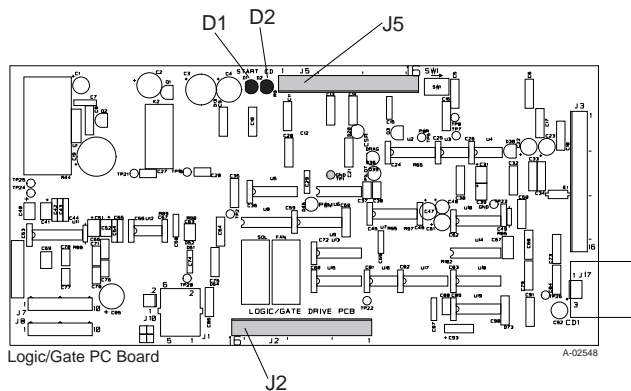
1. Work cable not connected.
 - a. Connect work cable.

2. Faulty Logic Gate

Check the following indicators inside the power supply:

- Pilot Indicator (D39) on the Logic/Gate PC Board is ON during the pilot then OFF during the main arc transfer
- CSR indicator (D20) on the Logic/Gate PC Board is OFF during the pilot then ON during the main arc transfer

While trying to transfer, measure voltage. If D20 on the Logic/Gate PC Board does not turn on, replace Logic/Gate PCB.



B. When operating at amperages over 35 amps, the amperage drops off after the main cutting arc initiates.

Check the following indicator inside the Power Supply:

- Drag indicator (D36) on the Logic/Gate PC Board is ON when the torch tip comes in contact with the workpiece.

1. Cutting tip in contact with the workpiece.

- a. Maintain standoff distance 1/8"-3/8" between cutting tip and workpiece. (See SW-1 Drag Disable)

2. Faulty PCR Relay

- a. With power off, measure for continuity between wires #12 and #14. If continuity is found, replace PCR.

3. Faulty Logic/Gate PC Board

If torch tip is off the workpiece and the drag indicator, D36, on the Logic/Gate PC Board is still ON, then replace the Logic/Gate PC Board.

4.09 Test Procedures

The test procedures in this subsection are referenced in the troubleshooting section.

A. Safety Precautions

1. Significant DC Voltage exists after removal of input power. Allow 2 minutes for discharge time. Voltage measured on input capacitors must be zero before performing service on the power supply.
2. Do Not touch electrical components with any part of the human body when power is applied.
3. Keep away from any moving parts.
4. Hot surfaces can cause severe burns. Allow equipment to cool before servicing.
5. Electrostatic discharge can damage printed circuit board assemblies. Transport printed circuit boards in proper anti-static shielded packages. Use proper grounding techniques with wrist strap before handling printed circuit boards.
6. Misaligned plugs can cause printed circuit board damage. Be sure plugs are properly aligned and completely seated.
7. Excessive pressure can damage printed circuit board. Use only minimal pressure and gentle movement when disconnecting or connecting printed circuit board plugs.

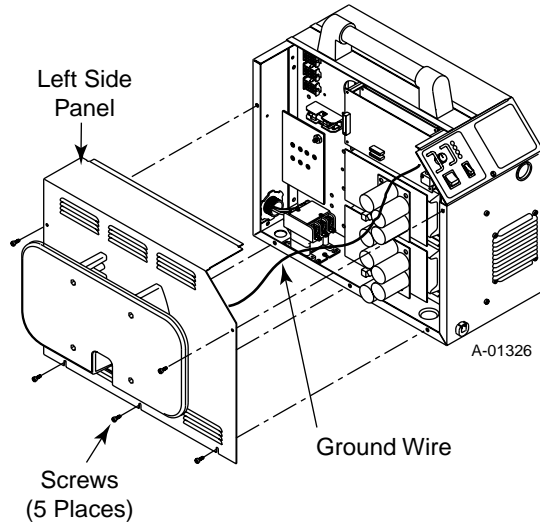
B. Opening Power Supply Enclosure

The left side panel of the Power Supply must be removed to gain access to the input power connections and the input voltage selection.



Disconnect primary power at the source before assembling or disassembling the Power Supply, torch parts, or torch and leads assemblies.

1. Using a phillips head screw driver remove the five screws which secure the left side panel (viewed from front of unit) to the frame assembly.



2. Carefully pull the left side panel from the Power Supply a short distance (see note).

NOTE

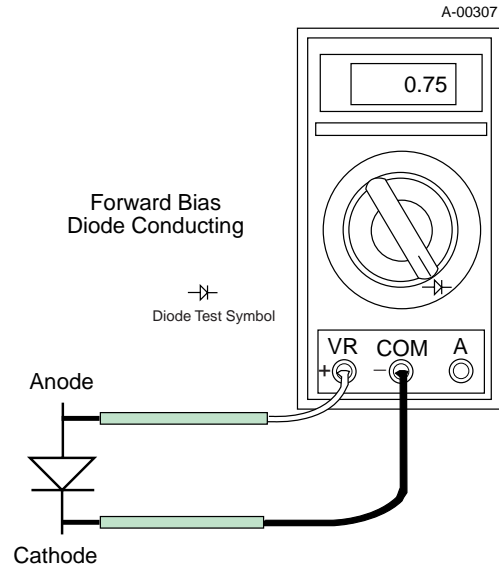
There is a ground wire attached to the side panel.

3. Remove the nut securing the ground wire to the side panel.
4. Close the enclosure by reversing the above steps.

C. Diode Testing Basics

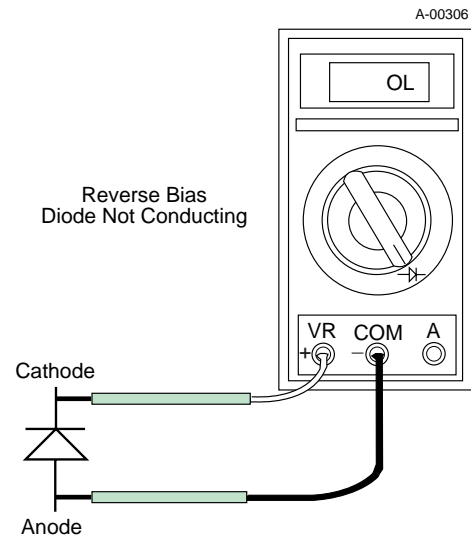
Testing of diode modules requires a digital volt/ohmmeter that has a diode test scale. Remember that even if the diode module checks good, it may still be bad. If in doubt, replace the diode module.

1. Locate the diode module to be tested.
2. Remove cables from mounting studs on diodes to isolate the module.
3. Set digital volt/ohmmeter to diode test scale.
4. Using the Figures for each test, check each diode in the module. Each diode must be checked in forward bias (plus to negative) and reverse bias (negative to plus) direction.
5. Connect the volt/ohmmeter positive lead to the anode (+) of the diode and the negative lead to the cathode (-) of the diode for forward bias testing (refer to following figure). A properly functioning diode will conduct in the forward bias direction and indicate between 0.3 to 0.9 volts.



Testing Diode Forward Bias

6. Reverse the meter leads across the diode for reverse bias testing (refer to following figure). A properly functioning diode will block in the reverse bias direction and depending on the meter function will indicate an open or "OL".

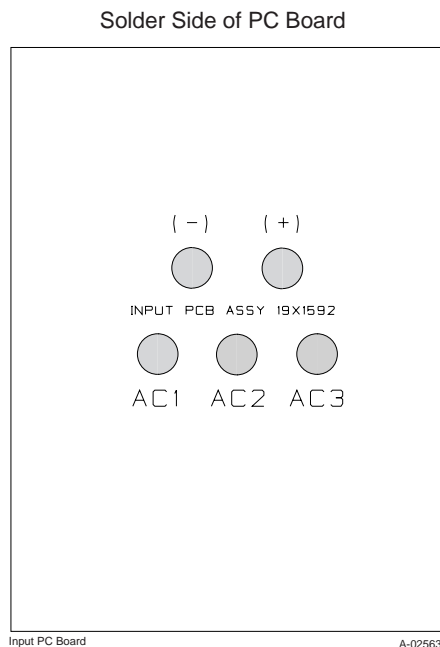


Testing Diode Reverse Bias

7. If a diode checks bad, replace the diode module.
8. Reconnect all cables to proper terminals.

D. Input PC Board/Input Diode Test

Check Input PC Board for shorted input diode.



Remove AC power and with an ohmmeter set on the diode range make the following checks:

Meter (+)	Meter (-)	Indication
AC1	+	Diode Drop
+	AC1	Open
AC2	+	Diode Drop
+	AC2	Open
AC3	+	Diode Drop
+	AC3	Open
AC1	(-)	Open
(-)	AC1	Diode Drop
AC2	(-)	Open
(-)	AC2	Diode Drop
AC3	(-)	Open
(-)	AC3	Diode Drop

The meter should indicate a diode drop in one direction and an open in the other direction for each check.

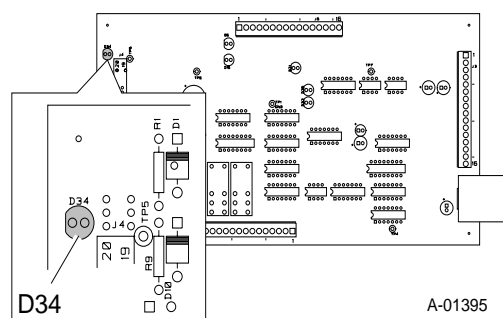
If Input Bridge Diode is shorted, make the following checks with an ohmmeter at the Main Contactor:

Meter (+)	Meter (-)	Indication
L1	T1	Open
L2	T2	Open
L3	T3	Open

If any test has resistance, then replace the Main Contactor also.

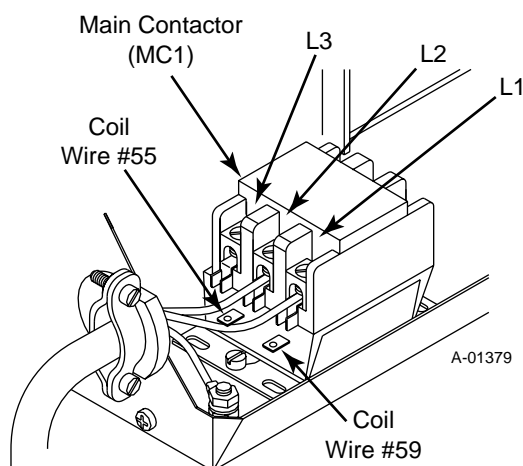
E. Main Contactor (MC1) Test

Reconnect power and observe proper start-up procedure. AC LED Indicator on the Front Panel should be ON. If indicator is OFF there is no voltage to the Power Supply or an overvoltage condition exists.



If indicator AC LED Indicator on Front Panel is OFF check for proper AC input voltage per the following:

- **Single Phase Units** check at L1 and L2
- **Three Phase Units** check L1, L2, and L3



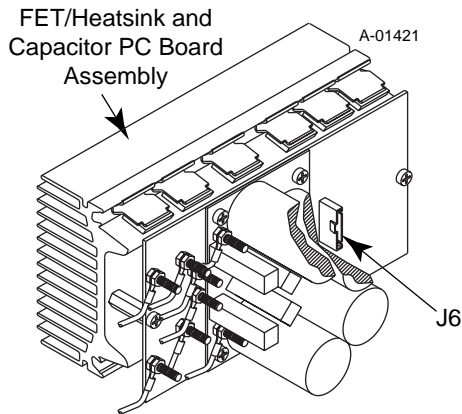
Measure voltage on coil of contactor, approximately 117 VAC between wires #70 and #75.

- If voltage is correct, replace Main Contactor.
- If voltage is incorrect, replace Logic/Gate PC Board.

F. Temperature Circuit Test

Test the temperature circuit per the following:

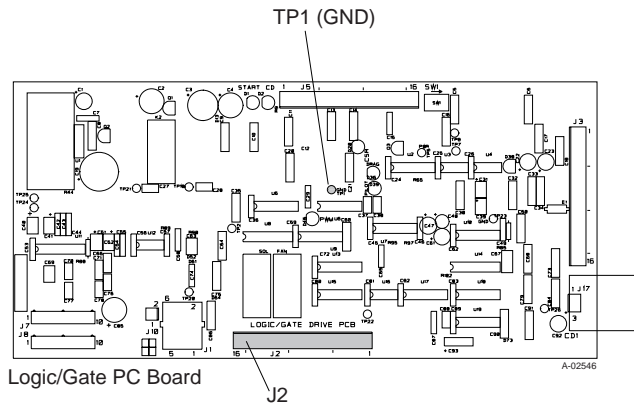
1. Place the front panel ON/OFF switch to the OFF position.
2. Disconnect ribbon cable from the Upper FET/Heatsink Assembly at J6.



3. Place the front panel ON/OFF switch to ON.
4. Check status of the TEMP indicator. If indicator has gone OFF, then remove power and replace the Upper FET/Heatsink Assembly.
5. Place the front panel ON/OFF switch to the OFF position.
6. Disconnect ribbon cable from the Lower FET/Heatsink Assembly at J6.
7. Place the front panel ON/OFF switch to ON.
8. Check status of the TEMP indicator. If indicator has gone OFF, then remove power and replace the Lower FET/Heatsink Assembly.
9. Place the front panel ON/OFF Switch to the OFF position.
10. Remove power from unit.
11. Disconnect connector from J2.
12. Check for short on connector (harness end) between J2-15 & 16.

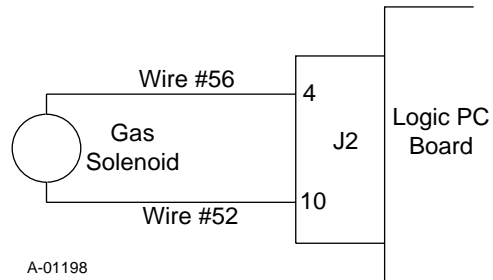
If shorted, Replace TS1.

If no short, replace Logic/Gate PC Board.



G. Gas Solenoid Circuit Test

Make the following voltage checks per the circuit diagram and replace the faulty part as required.



1. Check for 115 VAC from Wire #56 to wire #52 at the gas solenoid.
If approximately 115 VAC replace solenoid.
If no voltage is present proceed to Step 2.
2. Measure for 115 VAC from J2-4 to J2-10 at the Logic/Gate PC Board.
If voltage is not correct replace Logic/Gate PC Board.

H. Pilot Arc Circuit

1. Check across E23 to E24 at the Pilot Output PC Board. There should be a diode drop across E23 to E24 in one direction and an open in the other.
If shorted, remove the wires at E23 and E24 at the Pilot Output PC Board and check again.
Replace Pilot Output PC Board if shorted from E23 to E24 (with wires #17 and #16 removed).
Check for shorted torch Pilot Output PCB is not shorted. Check for short between E8 and E22.

If shorted, replace Pilot/Output PCB.

2. Measure between E9 to E8 and E24 on Pilot/Output PC Board. If shorted, remove wires on E8 E9 and E24 and re-check PCB.

If shorted, replace Pilot/Output PCB.

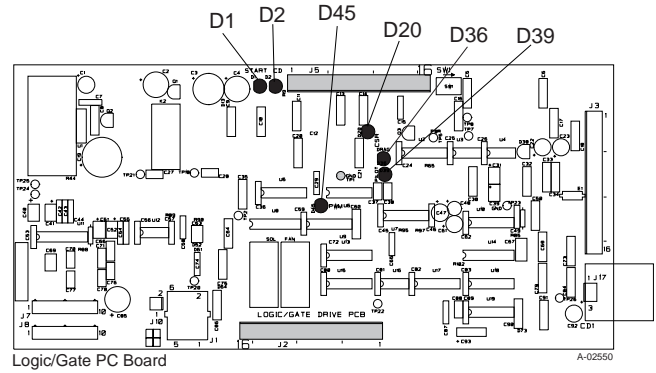
If no longer measures shorted, check for short in torch or leads.

I. FET/Heatsink Circuit Tests

The FET/Heatsink circuit tests require various checks to isolate the possible fault to the FET/Heatsink Assembly. There are several internal indicators (LED's) on the Logic/Gate PC Board to help in troubleshooting.

The indicators on the Logic/Gate PC Board as follows:

Indicator	Meaning
D15	Torch Switch Enable - When ON indicates torch switch is pressed.
D2	CD Enable - Initiates spark gap on CD PC Board. Indicator should come ON then go OFF after a pilot arc has been established.
D20	CSR - Indicates main cutting arc is established.
D39	Pilot ON - Indicates that a PCR Relay drive is active. OFF during cutting.
D45	PWM Enable - indicates PWM IC which provides Gate Drive signal to FET PCB is active.
D36	Drag On - When ON indicates that the torch tip is making contact with the workpiece.



1. No DC Output

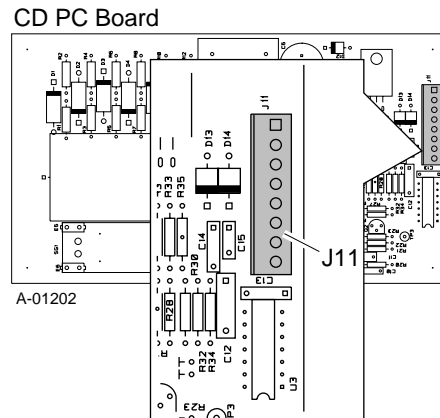
An open circuit voltage of approximately 280 to 325 VDC (depending on input power selected) is produced when switching transistors in the FET/Heatsink Assemblies are turned ON by a PWM Enable signal from the Logic/Gate PC Board. A circuit on the Logic/Gate PC Board monitors the output voltage. When the output voltage drops below 60 VDC, indicating a problem exists, the Logic/Gate PC Board sends a signal which turns OFF the PWM Enable signal to the Logic/Gate Drive PC Board. Because this happens in less than 50 milliseconds, it is not easy to take voltage readings to find the source of the problem.

The Torch Switch Enable indicator, D1, turns ON when the torch switch is pressed. At this point the gas begins to flow. When the preflow time is over the PWM Enable signal is given, PWM turns on, and the DC indicator at the front panel turns ON. When the PCR Drive/Pilot On Indicator, D39, turns ON.

If the PWM Enable indicator, D45, does not come ON then replace the Logic/Gate PCB.

If the PWM Enable indicator, D45, turns ON then OFF immediately, the following test should be performed:

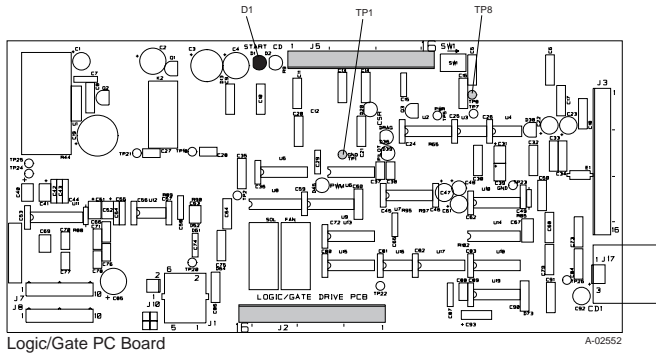
- a. Disconnect J11 from the CD PC Board to disable the CD signal.



- b. Connect a jumper between TP1 and TP8 on the Logic/Gate PC Board in the unit.

NOTE

Before pressing the trigger, make sure no faults were found on the Pilot Board and in the torch.



This will cause the gas to flow continuously and the DC indicator on the front panel to turn ON.



WARNING

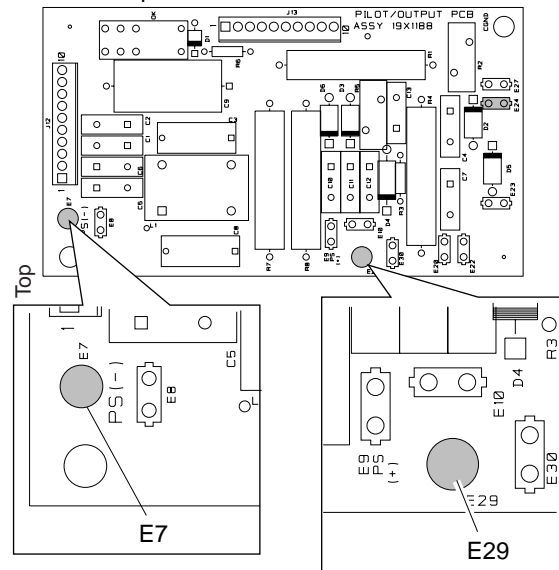
Connector J11 on the CD PC Board must be disconnected to prevent electrical damage to measuring equipment when testing the open circuit voltage (OCV)

- c. Press and hold the hand torch switch (Logic/Gate PC Board Start indicator, D1, turns ON). After 2 seconds D45 turns on (Logic/Gate PCB). If D45 does not turn on, replace Logic/Gate PBB.
- d. Measure open circuit voltage between E29 (+) to E7 (-) at the Pilot Output PC Board.
- e. If voltage is low, disconnect wire from E24 on the Pilot Output Board and recheck steps c-d. If voltage is okay, then check torch & leads. If voltage is still low, disconnect wires 11-12 (from FET PCB to Pilot Output PCB). If voltage approximately 325, check torch * & leads.

Make sure wires #11 & #12 which connect the FET assemblies to each other remain connected. Check for output voltage between E17 & E18. If voltage is OV-, replace both FET Assemblies. If voltage is approximately 325 VDC, replace Pilot/Output PC Board.

Pilot Output PC Board

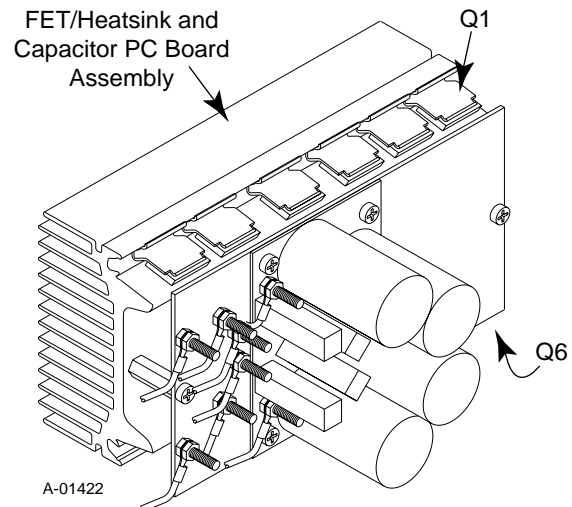
A-01401



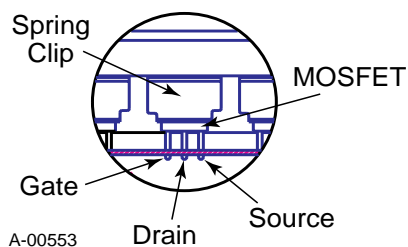
2. MOSFET Resistance Checks

The Power Supply contains two identical FET/Heatsink Assemblies. On each assembly there are two MOSFET devices that must be checked. Use an ohm-meter to check for the proper resistance of the MOSFET's per the following procedure:

- a. Locate Q1 and Q6 on the FET/Heatsink Assembly.



- b. Place the meter (+) lead on gate lead of Q1 and meter (-) lead on source lead of Q1. The meter should indicate approximately 2.5K ohms.



- c. Place the meter (+) lead on drain lead of Q1 and meter (-) lead on source lead of Q1. The meter should indicate >100K ohms.

NOTES

Make measurements near the body of each MOSFET.

Be sure that the meter lead probes penetrate the protective coating on the MOSFET.

- d. Place the meter (+) lead on drain lead of Q1 and meter (-) lead to the heatsink. The meter should indicate >1 meg ohms.
- e. Place the meter (+) lead on gate lead of Q6 and meter (-) lead on source lead of Q6. The meter should indicate approximately 2.5K ohms.
- f. Place the meter (+) lead on drain lead of Q6 and meter (-) lead on source lead of Q6. The meter should indicate >100K ohms.

3. FET Reset Diode Check

Use an ohmmeter set to the diode function and check the reset diode per the following procedure:

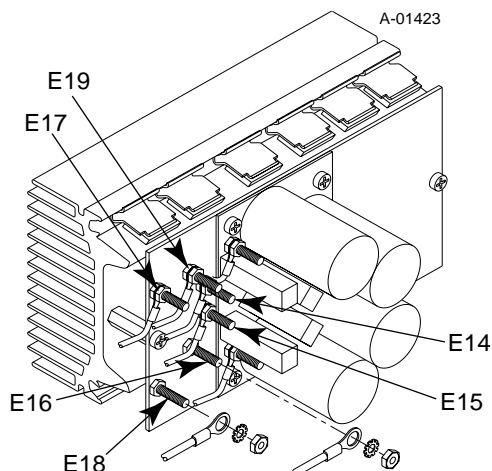
- a. Place the meter (+) lead on E14 and the meter (-) lead on E1B of the FET/Heatsink Assembly Capacitor PC Board to check the reset diode. The meter should indicate between 0.4 to 0.6 volts using the diode function.
- b. Reverse the meter leads and the indication should be a capacitor charging.
- c. Place the meter (-) lead on E14 and the meter (+) lead on E2B of the FET/Heatsink Assembly Capacitor PC Board to check the reset diode. The meter should indicate between 0.4 to 0.6 volts using the diode function.
- d. Reverse the meter leads and the indication should be a capacitor charging.

If the indication is a short, then replace the FET/Heatsink Assembly.

4. FET Output Rectifier Check

Use a digital meter, diode or ohms function, to check the forward and reverse bias of the output rectifiers on the FET/Heatsink Assemblies per the following procedure:

- a. Remove the wire from E16 and E18 on the Upper and Lower FET/Heatsink Assemblies.



- b. Place the meter (+) lead on E16 and the meter (-) lead on E18 of the FET/Heatsink Assembly to check the output rectifier forward bias. The meter should indicate between 0.3 to 0.6 volts using the diode function or 100K ohms using the ohms function.
- c. Place the meter (+) lead on E18 and the meter (-) lead on E16 of the FET/Heatsink Assembly to check the output rectifier reverse bias. The meter should indicate 'OL' using the diode function or 100K ohms using the ohms function.
- d. Place the meter (+) lead on E17 and the meter (-) lead on E19 of the FET/Heatsink Assembly to check the output rectifier forward bias. The meter should indicate between 0.3 to 0.6 volts using the diode function or 100K ohms using the ohms function.
- e. Place the meter (+) lead on E19 and the meter (-) lead on E17 of the FET/Heatsink Assembly to check the output rectifier reverse bias. The meter should indicate 'OL' using the diode function or 100K ohms using the ohms function.
- f. Place the meter (+) lead on E18 and the meter (-) lead on the heatsink of the FET/Heatsink Assembly to check the output rectifier resistance to ground. The meter should indicate >1 meg ohms.

Replace the FET/Heatsink Assembly if any of the above tests are open or shorted.

5. FET Output Clamp Diodes Check

Use an ohmmeter to check the resistance of the output clamp diodes, (+ out) E17 and (- out) E18, per the following procedure:

NOTE

The wires on E16 and E18 should still be disconnected from both FET/Heatsink Assemblies.

- a. Place the meter (+) lead on E17 and the meter (-) lead on E18 of the FET/Heatsink Assembly to check the output clamp diode resistance. The meter should indicate >1 meg ohms.
- b. Place the meter (+) lead on E18 and the meter (-) lead on E17 of the FET/Heatsink Assembly to check the output clamp diode resistance. The meter should indicate >1 meg ohms.

Replace the FET/Heatsink Assembly if any of the above tests are open or shorted.

SECTION 5: REPAIRS & REPLACEMENT PROCEDURES

5.01 Introduction

This section describes parts replacement procedures and all cable repairs which may be performed on the Pak Master 50XL PLUS Power Supply.

Under no circumstances are field repairs to be attempted on Printed Circuits or other Subassemblies of this unit. Evidence of unauthorized repairs may void the factory warranty.

5.02 Anti-Static Handling Procedures

A. General

CAUTION

PC boards can be irreparably damaged by improper handling due to electrostatic discharge (ESD).

Replacement PC boards are shipped in a protective enclosure to prevent damage from electrostatic discharge (ESD) during shipping. Included with each replacement board is a ground strap to prevent static damage during installation.



WARNINGS

Read and understand these instructions and the instructions on the grounding wrist strap package before opening the equipment enclosure or removing the replacement PC board from its protective enclosure.

Disconnect primary power to the system before disassembling the torch, torch leads, or power supply enclosure.

Do not operate the equipment or test equipment under power while wearing the grounding wrist strap.

B. Procedure

1. Open the wrist strap and unwrap the first two folds of the band. Wrap the adhesive side firmly around your wrist.

2. Unroll the rest of the band and peel the liner from the copper foil at the opposite end.
3. Attach the copper foil to a convenient and exposed electrical ground.
4. Connect the equipment primary cable ground to the same electrical ground as the wrist strap.
5. Open the equipment enclosure (see instruction manual for the appropriate equipment) and remove the failed PC board.
6. Carefully open the ESD protective bag and remove the replacement PC board.
7. Install the replacement PC board in the equipment and make all necessary connections.
8. Place the failed PC board in the ESD protective bag and seal for return shipping.
9. Reassemble the equipment enclosure (see instruction manual for the appropriate equipment).
10. Remove the grounding wrist strap from your wrist and from the electrical ground connection before reconnecting primary power to the equipment.

5.03 Parts Replacement - General Information

The parts replacement procedures described in this manual, except for filter replacement, require that the Power Supply be disassembled. The part to be replaced will determine to what extent the Power Supply must be disassembled.

NOTES

Before removing any connection mark each wire with the connection designation. When reassembling make sure the wires go to the proper terminals.

Note the routing of wires and make sure the wires are put back in the same place when reassembling the unit.

Each subsection is referenced to Section 6 for parts lists and overall detailed drawing.



WARNING

Disconnect primary power from the source before opening or disassembling the power supply. Make sure AC indicator on the Power Supply front panel is OFF.

Before disassembling any part of the Power Supply first read the procedure for the part to be replaced, then proceed with the disassembly.

5.04 Major External Parts Replacement

NOTE

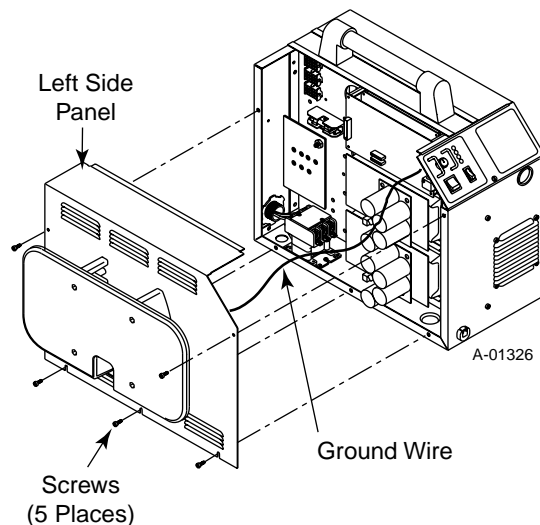
Refer to Section 6.03 for parts list and overall detail drawing.

A. Lifting Handle Replacement

1. Remove the two allen screws securing the ends of the handle to the top of the unit.
2. Remove the Lifting Handle from the two end mounting blocks.
3. Place the replacement Lifting Handle into the mounting blocks.
4. Secure the Lifting Handle to the top of the unit with the two allen screws.

B. Left Side Panel Replacement

1. Using a phillips head screwdriver remove the five screws which secure the Left Side Panel to the Frame Assembly.



2. Carefully pull the Left Side Panel up and away from the unit far enough to gain access to the ground wire connection on the inside of the panel.
3. Remove the nut from the ground stud on the side panel and remove the ground wire.

4. Remove the four screws securing the Leads Wrap to the old Left Side Panel.
5. Install the replacement Left Side Panel by reversing the above procedure noting the following:
 - Leads Wrap must be installed on the replacement Left Side Panel before panel is installed.
 - Place the Left Side Panel onto the frame and slide the top edge under the lip on the top of the Right Side Panel.

C. Right Side Panel Replacement

1. Remove the Lifting Handle per paragraph 'A' above.
2. Unlock the latch for the Access Panel.
3. Using a phillips head screwdriver remove the five screws which secure the Right Side Panel to the Frame Assembly.

NOTE

The three bottom screws need only be loosened to allow the panel to be removed.

4. Carefully pull the Right Side Panel up and away from the unit far enough to gain access to the wire connections on the inside of the Access Panel.
5. Disconnect the LED/POT PC Board wiring connector from J3 at the Logic/Gate PC Board.
6. Remove the two nuts securing the Access Panel to the Right Side Panel.
4. Install the replacement Right Side Panel by reversing the above procedure noting the following:
 - a. Install the Access Panel onto the replacement Right Side Panel.
 - b. Place the Right Side Panel onto the frame and slide the lip on the top edge over the edge on the top of the Left Side Panel.

D. Leads Wrap Replacement

1. Remove the Left Side Panel per Section 5.04-B.
2. Remove the four screws securing the Leads Wrap to the Left Side Panel.
3. Install the replacement Leads Wrap by reversing the above procedure.

5.05 Access Panel Parts Replacement

NOTE

Refer to Section 6.04 for parts list and overall detail drawing.

A. CURRENT Knob Replacement

1. Turn the CURRENT adjustment fully counter clockwise and note the location of the pointer on the knob.
2. Loosen the screw securing the Current Knob to the potentiometer shaft.
3. Remove the old knob.
4. Place the replacement Current Knob on to the potentiometer shaft with the location of the pointer the same as noted in step 1.
5. Tighten the screw to secure the knob to the potentiometer shaft.

B. ON/OFF Switch Replacement

1. Unlatch the Access Panel to gain access to the rear of the ON/OFF Switch.
2. Disconnect all the wiring to the ON/OFF Switch.
3. Squeeze the top and bottom of the switch while pulling it out of the Access Panel
4. Install the replacement ON/OFF Switch by reversing the above procedure.

C. RUN/SET/LATCH Switch Replacement

1. Unlatch the Access Panel to gain access to the rear of the RUN/SET/LATCH Switch.
2. Disconnect all the wiring to the RUN/SET /LATCH Switch.
3. Squeeze the top and bottom of the switch while pulling it out of the Access Panel
4. Install the replacement RUN/SET/LATCH Switch by reversing the above procedure.

D. Pot/LED PC Board Assembly Replacement

1. Turn the CURRENT adjustment fully counter clockwise and note the location of the pointer on the knob.
2. Loosen the screw securing the Current Knob to the potentiometer shaft.
3. Remove the Current Knob.

4. Unlatch the Access Panel to gain access to the Pot/LED PC Board.
5. Remove the Pot/LED PC Board from the four stand-offs.
6. Disconnect the connector at J14 of the Pot/LED PC Board.
7. Install the replacement Pot/LED PC Board by reversing the above procedure.

E. Access Panel Replacement

1. Remove the Right Side Panel per Section 5.04-C.
2. Remove the following components from the Access Panel:
 - Current Knob per paragraph 'A' above.
 - ON/OFF Switch per paragraph 'B' above.
 - RUN/SET Switch per paragraph 'C' above.
 - Pot/LED PC Board per paragraph 'D' above.
 - Ground Wire
3. Remove the two nuts and washers securing the Access Panel to the Right Side Panel.
4. Install the replacement Access Panel by reversing the above procedure.

5.06 Front Panel Parts Replacement

NOTE

Refer to Section 6.05 for parts list and overall detail drawing.

A. Work Cable Replacement

1. Remove the Left Side Panel per Section 5.04-B.
2. Remove the Right Side Panel per Section 5.04-C.
3. Loosen the Work Cable end at the terminal on the Output PC Board.
4. Remove the Work Cable end from the Output PC Board terminal.
5. Remove the tie-wrap holding the Work Cable to the CD Coil Lead.
6. Carefully pull the Work Cable out through the Bushing in the Center Chassis.
7. Continue pulling the Work Cable down through the current sensor mounted on the Logic/Gate PC Board.
8. Remove the Work Cable strain relief from the Front Panel.

9. Pull the Work Cable from the unit.
10. Install the replacement Work Cable by reversing the above procedure.

B. Main Contactor Replacement

1. Remove the Left Side Panel per Section 5.04-B.
2. Note the orientation of all the wires and then disconnect the input and output wiring from the Main Contactor Assembly.
3. Remove the two nuts and washers securing the Main Contactor to the bottom of the unit.
4. Install the replacement Main Contactor Assembly by reversing the above procedure.

C. Fan Replacement

1. Remove the Left Side Panel per Section 5.04-B.
2. Note the orientation of the Fan Assembly wiring push on connectors.
3. Carefully pull the wiring connectors from the lugs on the Fan Assembly.
4. Locate and remove the four phillips head screws securing the Fan Assembly to the Front Panel Assembly.
5. Carefully pull the Fan Assembly from the Front Panel Assembly.
6. Install the replacement Fan Assembly by reversing the above procedure.

D. Unit Base/Front Replacement

1. Remove the Left Side Panel per Section 5.04-B.
2. Remove the Right Side Panel per Section 5.04-C.
3. Remove the Work Cable per paragraph 'A' above.
4. Remove the Torch from the unit.
5. Remove the two Fan Assemblies from the Base/Front Panel Assembly per paragraph 'C' above.
6. Remove the following hardware:
 - a. Two mounting nuts from Main Contactor Assembly.
 - b. Nut and wire from ground stud.
 - c. Bottom two screws securing Rear Panel to Base/Front Assembly.
 - d. On the right side remove the two screws securing the Pilot Panel to the Base/Front Panel Assembly.

- e. On the right side remove the three nuts and washers securing the internal chassis to the bottom of the unit.

7. At the front panel remove the two screws securing the Base/Front Panel to the internal chassis.
8. Carefully slide the internal components up, back, and out of the Base/Front Assembly.
9. Install the replacement Base/Front Assembly by reversing the above procedure.

5.07 Left Side Internal Component Parts Replacement

NOTE

Refer to Section 6.06 for parts list and overall detail drawing.

A. Fuse Replacement

1. Remove the Left Side Panel per Section 5.04-B.
2. Remove the Fuse from the fuse holder.
3. Replace the Fuse with 0.8A 600V fuse.
4. Reinstall the Left Side Panel.

B. Fuse Holder Replacement

1. Remove the Left Side Panel per Section 5.04-B.
2. Remove the Fuse from the holder.
3. Disconnect the two wires connected to the Fuse Holder.
3. Remove the two small screws securing the Fuse Holder to the chassis.
4. Install the replacement Fuse Holder by reversing the above procedure.

C. Input PC Board Assembly Replacement

1. Remove the Left Side Panel per Section 5.04-B.
2. Remove the five screws securing the wiring to the Input PC Board.
3. Remove the clear Input PC Board Insulator sheet.
4. Remove the two screws at 'R2' and 'G'.
5. Carefully pull the Input PC Board from the unit far enough to disconnect the wiring connections to the component side of the PC board.
6. Install the replacement Input PC Board by reversing the above procedure noting the following:

NOTE

Failure to properly tighten the seven screws securing the Input PC Board to the Diode Bridge will cause damage to the unit.

- The five screws securing the wiring and Input PC Board to the Diode Bridge must be tight enough to prevent the wires from moving.
- The two screws securing the Input PC Board to the Diode Bridge at 'R2' and 'G' must be tight.

D. Input Diode Bridge Assembly Replacement

1. Remove the Left Side Panel per Section 5.04-B.
2. Remove the Input PC Board per paragraph 'C' above.
3. Remove the two nuts securing the Input Diode Bridge to the Center Chassis.
4. Remove the Input Diode Bridge Assembly from the unit.
5. Remove the Thermal Pad from the Center Chassis.
6. Install the replacement Input Diode Bridge Assembly and new Thermal Pad by reversing the above procedure (see Note).

NOTE

The two nuts removed in Step 3 must be torqued to 35 in-lbs when reinstalled.

E. Logic/Gate Drive PC Board Replacement

1. Remove the Left Side Panel per Section 5.04-B.
2. Carefully remove all cable connections from the Logic/Gate PC Board noting the location of each.
3. Remove the four screws securing the Logic/Gate PC Board to the standoffs.
4. Remove the Work Cable per the following:
 - a. Remove Right Side Panel per Section 5.04-C.
 - b. Loosen the Work Cable end at the terminal on the Output PC Board.
 - c. Remove the Work Cable end from the Output PC Board terminal.
 - d. Remove the tie-wrap holding the Work Cable to the CD Coil Lead.
 - e. Carefully pull the Work Cable out through the Bushing in the Center Chassis.
 - f. Continue pulling the Work Cable down through the current sensor mounted on the Logic/Gate PC Board.

5. Install the replacement Logic/Gate PC Board by reversing the above procedure.

F. FET/Heatsink Assembly Replacement

NOTE

The two FET/Heatsink Assemblies are identical and are removed in the same manner.

1. Remove the Left Side Panel per Section 5.04-B.
2. Place the unit on its right side.
3. Remove the Ribbon Cable plug at J6 on the FET/Heatsink Assembly. To remove the cable, push down on the locking tab and pull the cable plug out of the connector.
4. Disconnect all the wire lug connections to the FET/Heatsink Assembly.

Connection	Description
E14	Main Transformer (Primary)
E15	Main Transformer (Primary)
E16	Main Transformer (Secondary)
E17	(-) Output
E18	(+) Output
E19	Main Transformer (Secondary)
E25	(+) From Input Section Assembly
E26	(-) From Input Section Assembly

5. Disconnect the wiring from wire lug connections on the Capacitor PC Board at '+' and '-' terminals.
6. Remove the two screws securing the Heatsink Mounting Bracket to the chassis.
7. Lift up on the middle where the two FET/Heatsink Assemblies come together and remove the Mounting Bracket.
8. Slide the FET/Heatsink Assembly out and up to remove the FET/Heatsink Assembly from the unit.
9. Install the replacement FET/Heatsink Assembly by reversing the above procedure.

NOTE

Be sure that the top groove in the FET/Heatsink Assembly is properly seated over the cutout in the chassis.

5.08 Rear Panel Parts Replacement

NOTE

Refer to Section 6.07 for parts list and overall detail drawing.

A. Two Stage Air Line Filter Replacement

NOTE

This part is an option and may not be installed on all units.

1. Disconnect the gas supply hose from the IN side of the Two Stage Filter Assembly.
2. Pull the Two Stage Filter Assembly out of the mounting bracket.
3. Disconnect the output hose from the OUT side of the assembly.
4. Install the replacement Two Stage Filter Assembly by reversing the above procedure.

B. Pressure Switch Replacement

1. Remove the Right Side Panel per Section 5.04-C.
2. Disconnect the two wires connected to the Pressure Switch Assembly.
3. Remove the assembly from the T-fitting.
4. Install the replacement Pressure Switch Assembly by reversing the above procedure and noting the following:
 - Apply pipe thread sealant to the fitting before reassembling.

C. Solenoid Valve Replacement

1. Remove the Right Side Panel per Section 5.04-C.
2. Disconnect the two wires connected to the Pressure Switch Assembly.
3. Disconnect the two wires connected to the Solenoid Valve Assembly.
4. Disconnect the gas tube connected to the bottom of the T-fitting.
5. Remove the T-fitting and gas fitting from the Solenoid Valve Assembly.
6. Remove the Solenoid Valve Assembly from the straight brass fitting.
7. Install the replacement Solenoid Valve Assembly by reversing the above procedure.

D. Air Line Regulator Bracket Replacement

1. Disconnect the gas input hose from the input of the Air Line Regulator Assembly.
2. Remove the nut securing the Air Line Regulator to the mounting bracket.
3. Remove the four screws securing the Air Line Regulator Bracket to the Rear Panel.
4. Pull the bracket from the unit.
5. Install the replacement Air Line Regulator Bracket by reversing the above procedure.

E. Air Line Regulator Replacement

1. Disconnect the gas input hose from the input of the Air Line Regulator Assembly.
2. Remove the Right Side Panel per Section 5.04-C.
3. Disconnect the gas tube connected to the bottom of the T-fitting at the Solenoid Valve Assembly.
4. Remove the Air Line Regulator Bracket per paragraph 'D' above.
5. Pull the Air Line Regulator away from the Rear Panel far enough to disconnect the plumbing joint between the reducer and elbow fitting..
6. Remove the elbow fitting from the old assembly.
7. Install the replacement Air Line Regulator Assembly by reversing the above procedure and noting the following:
 - Apply pipe thread sealant to the fitting before reassembling.

5.09 Right Side Internal Component Parts Replacement

NOTE

Refer to Section 6.08 for parts list and overall detail drawing.

A. Pilot/Output PC Board Assembly Replacement

1. Remove the Right Side Panel per Section 5.04-C.

NOTES

Before removing any connection mark each wire with the connection designation. When reassembling this makes sure the wires go to the proper terminals.

Note the routing of wires and make sure the wires are put back in the same place when reassembling the unit.

2. Disconnect all the wiring connections to the Pilot/Output PC Board Assembly.
3. Remove the four screws and washers securing the PC Board to the standoffs.
4. Install the replacement Pilot/Output PC Board Assembly by reversing the above procedure.

B. CD PC Board Assembly Replacement

1. Remove the Right Side Panel per Section 5.04-C.

NOTES

Before removing any connection mark each wire with the connection designation. When reassembling this makes sure the wires go to the proper terminals.

Note the routing of wires and make sure the wires are put back in the same place when reassembling the unit.

2. Disconnect all the wiring connections to the CD PC Board Assembly.
3. Remove the four screws and washers securing the PC Board to the standoffs.
4. Install the replacement CD PC Board Assembly by reversing the above procedure.

C. Relay Replacement

1. Remove the Right Side Panel per Section 5.04-C.

NOTES

Before removing any connection mark each wire with the connection designation. When reassembling this makes sure the wires go to the proper terminals.

Note the routing of wires and make sure the wires are put back in the same place when reassembling the unit.

2. Disconnect all the wiring connections to the Relay Assembly.
3. Remove the two screws securing the Relay Assembly to the Pilot Panel.
4. Install the replacement Relay Assembly by reversing the above procedure.

D. Main Transformer Assembly Replacement

1. Remove the Left Side Panel per Section 5.04-B.
2. Remove the Right Side Panel per Section 5.04-C.
3. Remove the following terminal connections from the two FET/Heatsink Assemblies noting the location of each wire:

Connection	Description
E14	MAIN XFMR PRI
E15	XFMR PRI
E16	MAIN XFMR SEC
E19	XFMR SEC

4. Remove the four screws which hold the mounting plate to the bottom chassis.
5. Carefully remove the mounting plate with the Main Transformer Assembly from the unit.
6. Install the replacement Main Transformer Assembly by reversing the above procedure (see NOTE).

NOTE

The four screws securing the mounting plate to the chassis should have a maximum of 2 to 5 threads protruding through the left side of the chassis.

E. Output Inductor Assembly Replacement

1. Remove the Left Side Panel per Section 5.04-B.
2. Remove the Right Side Panel per Section 5.04-C.
3. Disconnect the lead wire on terminal E7 of the Pilot Output PC Board.

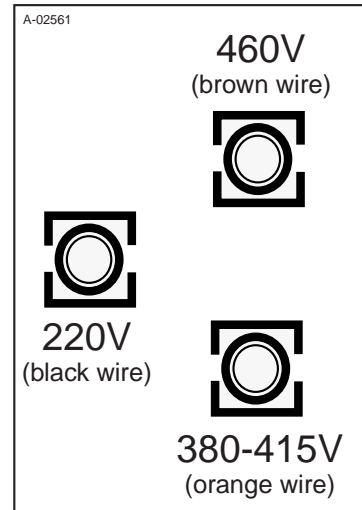
4. Disconnect the lead wire on terminal E17 of the top FET/Heatsink Assembly.
5. Remove the four mounting screws securing the Output Inductor Assembly to the chassis.
6. Remove the Output Inductor Assembly from the unit.
7. Install the replacement Output Inductor Assembly by reversing the above procedure (see NOTE).

NOTE

The four screws securing the mounting plate to the chassis should have a maximum of 2 to 5 threads protruding through the left side of the chassis.

F. Auxiliary Transformer Assembly Replacement

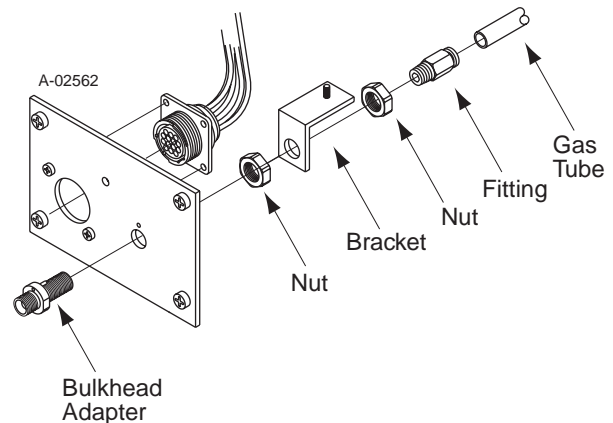
1. Remove the Left Side Panel per Section 5.04-B.
2. Remove the Right Side Panel per Section 5.04-C.
3. Disconnect the single pin connector on the white wire coming from the Auxiliary Transformer Assembly.
4. On the voltage selection panel remove the pin 13 from connectors J19 (black wire), J20 (orange wire), and J21 (brown wire) using a pin removal tool .
5. Disconnect the secondary wires by unplugging the J15 connector from the Logic/Gate PC Board.
6. Remove the four mounting screws securing the Auxiliary Transformer Assembly to the chassis.
7. Remove the Auxiliary Transformer Assembly from the unit.
8. Install the replacement Auxiliary Transformer Assembly by reversing the above procedure noting the following:
 - Brown wire to pin 13 of the top connector (J21) on the voltage selection panel.
 - Orange wire to pin 13 of the middle connector (J20) on the voltage selection panel.
 - Black wire to pin 13 of the lower connector (J19) on the voltage selection panel.



View of Voltage Selector Connectors
from the Left Side of
Center Chassis

G. Bulkhead Adapter Replacement

1. Remove the Right Side Panel per Section 5.04-C.
2. Remove Torch connection at the Bulkhead Adapter.



3. Disconnect the gas tube from the fitting at the end of the Bulkhead Adapter.
4. Remove the fitting.
5. Remove the first nut from the Bulkhead Adapter.
6. Carefully remove the wire from the Bulkhead Adapter that comes from the CD Transformer Coil.
7. Remove the second nut securing the Bulkhead Adapter to the Bulkhead.
8. Install the replacement Bulkhead Adapter by reversing the above procedure.

H. Fan Replacement

1. Remove the Left Side Panel per Section 5.04-B.

NOTE

The top and bottom Fan Assemblies are replaced in the same manner.

2. Remove the center chassis by following the procedure in Section 5.06-C.
3. Locate the wiring to the Fans and note the orientation of the Fan Assembly wiring push on connectors.
4. Carefully pull the wiring connectors from the lugs on the Fan Assembly.
5. Locate and remove the four phillips head screws securing the Fan Assembly to the internal chassis.
6. Carefully pull the Fan Assembly from the internal chassis.
7. Install the replacement Fan Assembly by reversing the above procedure.

NOTE

Refer to Section 6.08 for parts list and overall detail drawing.

SECTION 6: PARTS LISTS

6.01 Introduction

A. Parts List Breakdown

The parts lists provide a breakdown of all replaceable components. The parts lists are arranged as follows:

Section 6.03 Major External Replacement Parts List

Section 6.04 Access Panel Replacement Parts List

Section 6.05 Front Panel Replacement Parts List

Section 6.06 Left Side Internal Component Replacement Parts List

Section 6.07 Rear Panel Replacement Parts List

Section 6.08 Right Side Internal Component Replacement Parts List

Section 6.09 Options and Accessories

NOTE

Parts listed without item numbers are not shown, but may be ordered by the catalog number shown.

B. Returns

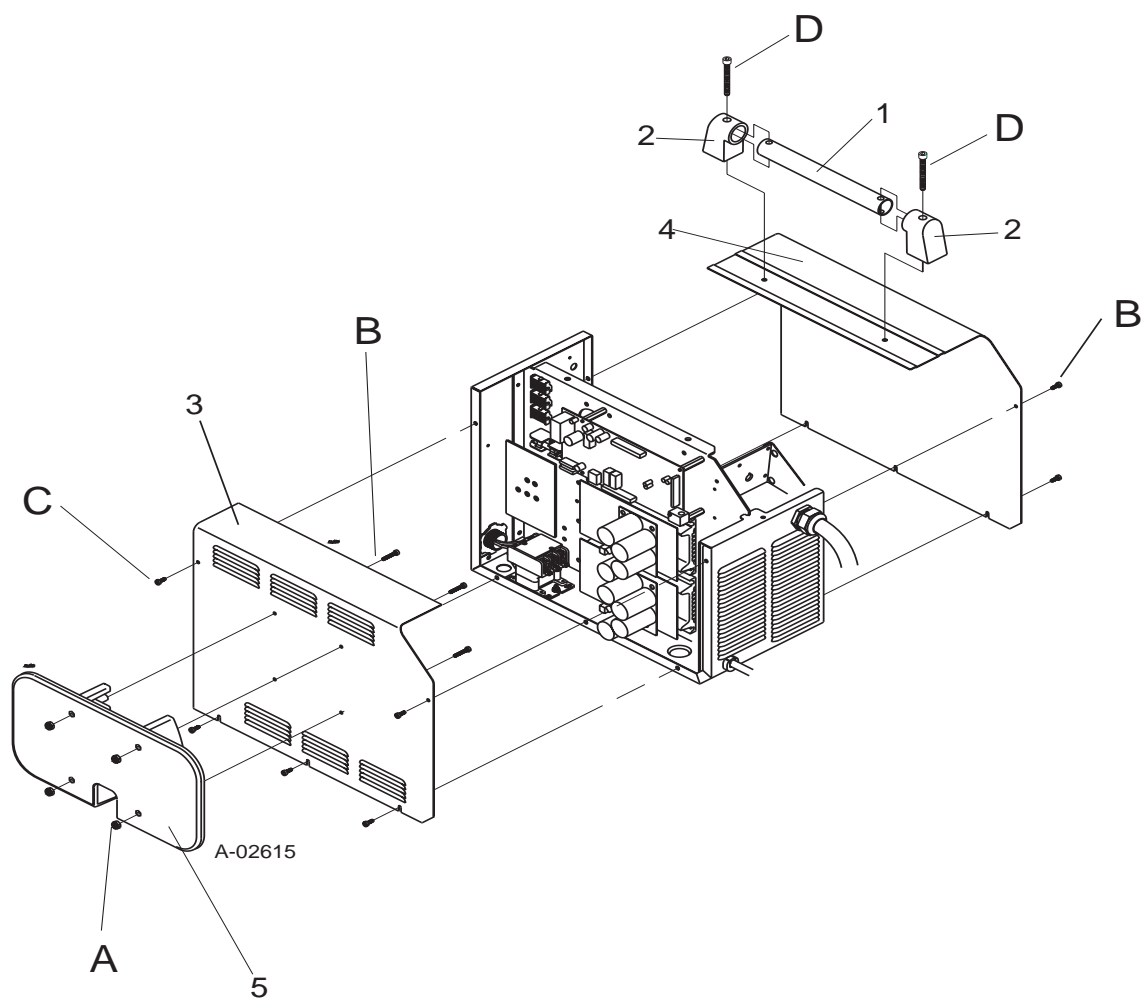
If a Thermal Dynamics product must be returned for service, contact your Thermal Dynamics distributor. Materials returned to Thermal Dynamics without proper authorization will not be accepted.

6.02 Ordering Information

Order replacement parts by catalog number and complete description of the part or assembly, as listed in the parts list for each type item. Also include the model and serial number of the torch. Address all inquiries to your authorized Thermal Dynamics distributor.

6.03 Major External Replacement Parts List

Item #	Qty	Description	Catalog #
1	1	TUBE, LIFTING HANDLE, 1.125 OD, 11.85 LG	9-7505
2	2	MOUNT, LIFTING HANDLE	9-7506
3	1	COVER, LEFT SIDE Includes: COVER LEFT SIDE LABEL, WARNING, ENGLISH	9-8001
4	1	LEADS WRAP Includes: PANEL, LEADS WRAP, MOLDED OVERLAY LH SIDE PANEL	9-8002
5	1	COVER, RIGHT SIDE Includes: COVER RIGHT SIDE OVERLAY, RH SIDE PANEL LABEL, WARNING, FRENCH	9-8003

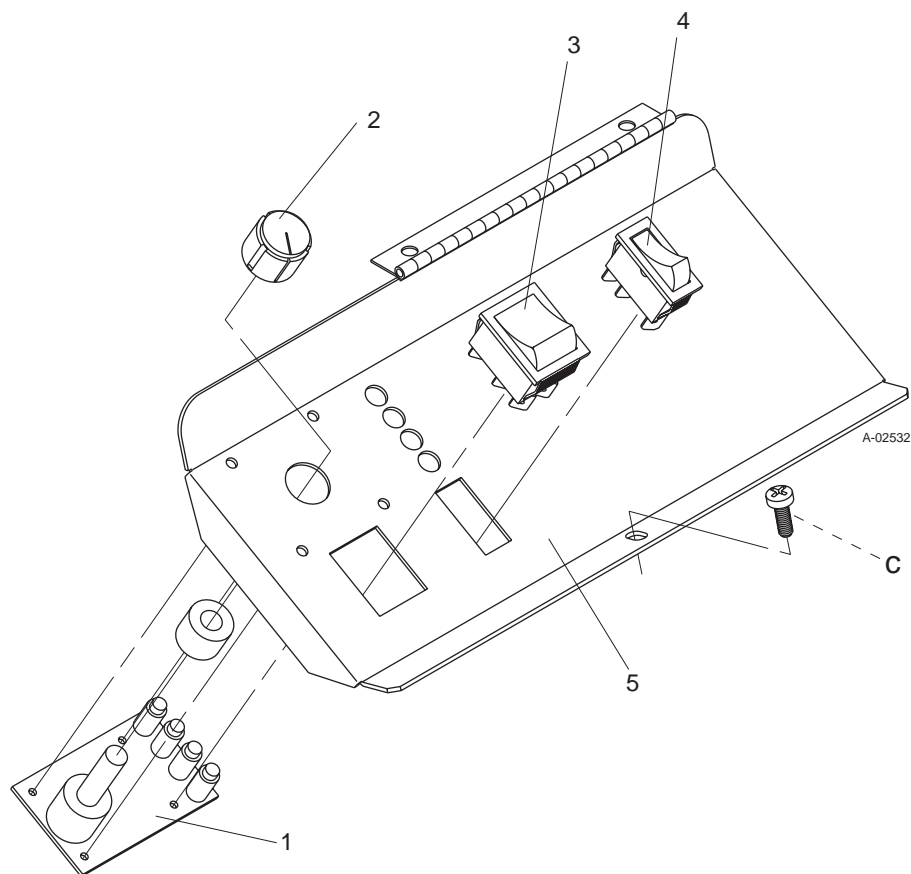


NOTE: Illustration may vary slightly from actual unit.

	HARDWARE
A	#10-32 Regular Nylon Lock Nut
B	#10-32 x 2" PPH HDMS
C	#10-32 x 0.5" PPH Sw ageform Stl Zn Screw
D	1/4-20 x 3" Screw , Soc HD
E	#6-32 x 3 1/2" THD Screw
F	#10-32 x 3/4" PPH Sw ag Screw
G	#6-32x3/8 PPH STL ZN Screw
H	Rubber Feet
I	#6-32x3 3/4 LG PH Screw
J	#10-32 Keput w/Star Washer

6.04 Access Panel Replacement Parts List

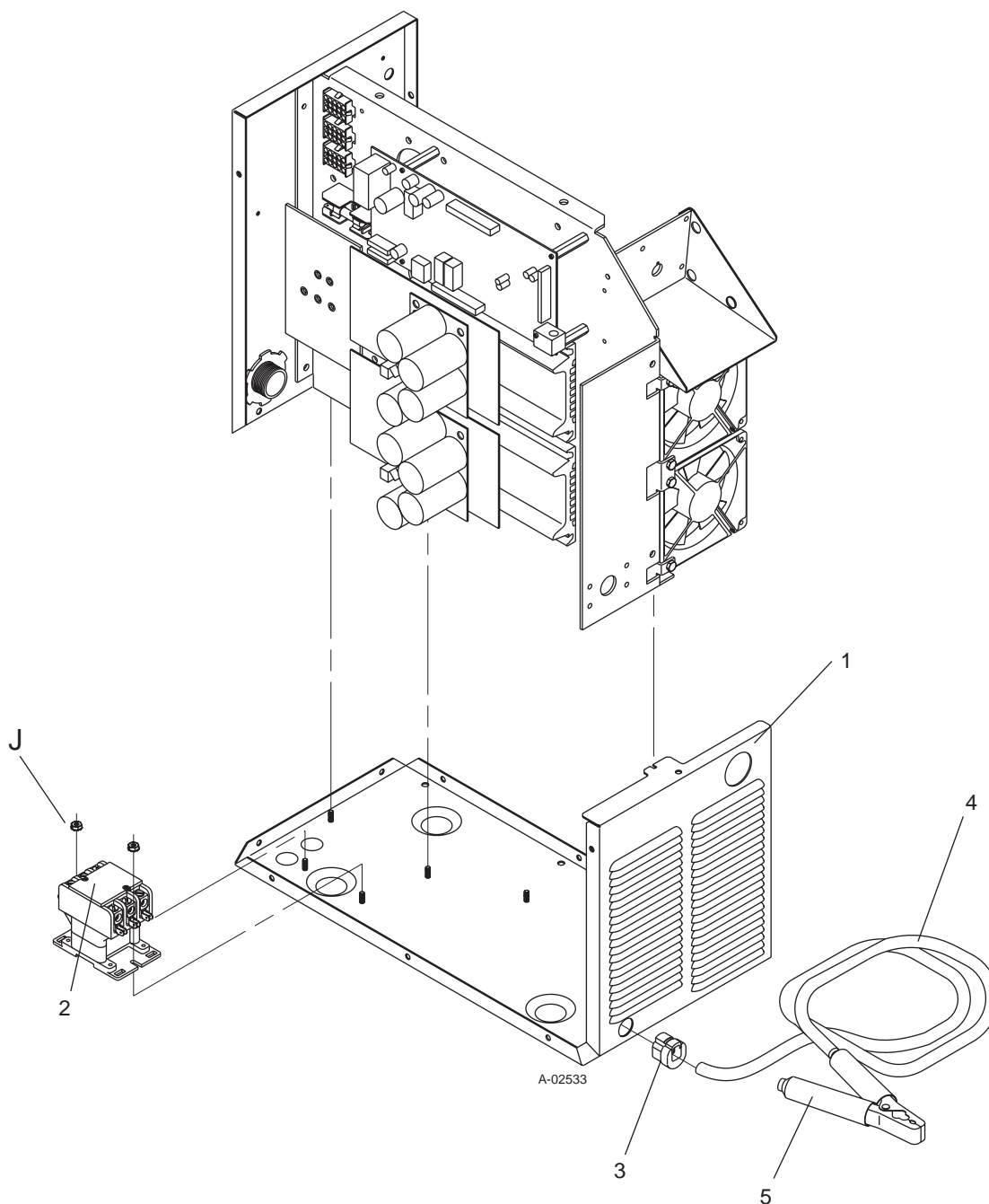
Items		Description	Ref. #	Catalog #
1	1	ASSEMBLY, POT/LED PCB		9-8004
2	1	KNOB, INNER CONCENTRIC		9-8007
3	1	SWITCH, ROCKER, SPST, CENTER OFF		8-3259
4	1	ON/OFF ROCKER SWITCH, DPST		8-3258
5	1	PANEL, ACCESS Includes: PANEL, ACCESS OVERLAY, ACCESS PANEL LABEL, ACCESS PANEL		9-8005



	HARDWARE
A	#10-32 Regular Nylon Lock Nut
B	#10-32 x 2" PPH HDMS
C	#10-32 x 0.5" PPH Sw ageform Stl Zn Screw
D	1/4-20 x 3" Screw , Soc HD
E	#6-32 x 3 1/2" THD Screw
F	#10-32 x 3/4" PPH Sw ag Screw
G	#6-32x3/8 PPH STL ZN Screw
H	Rubber Feet
I	#6-32x3 3/4 LG PH Screw
J	#10-32 Keput w/Star Washer

6.05 Front Panel Replacement Parts List

Item #	Qty	Description	Ref. #	Catalog #
1	1	PANEL, BASE/FRONT Includes: BASE/FRONT, UNIT GROUND TAG OVERLAY, FRONT PANEL W/USA LABEL		9-8006
2	1	CONTACTOR, 3P, 40 FLA, 600V, 115VAC COIL	MC1	9-7554
3	1	STRAIN RELIEF, FOR #6 STRANDED WIRE		8-5537
4	1	WORK CABLE, #6 AWG/WCLAMP - 20 FT		9-8008
5	1	CLAMP		9-8120



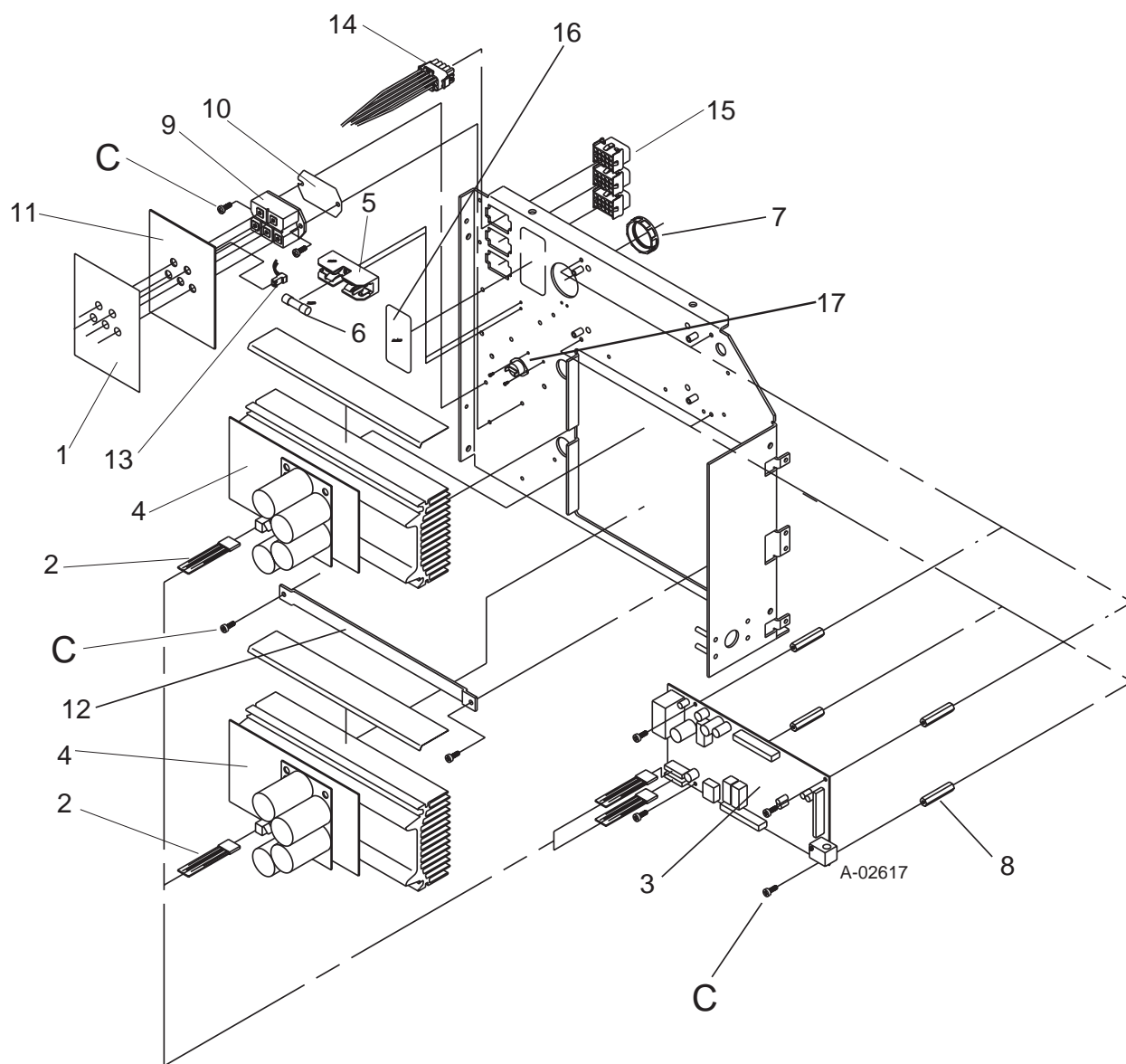
NOTE: Illustration may vary slightly from actual unit.

	HARDWARE
A	#10-32 Regular Nylon Lock Nut
B	#10-32 x 2" PPH HDMS
C	#10-32 x 0.5" PPH Sw ageform Stl Zn Screw
D	1/4-20 x 3" Screw , Soc HD
E	#6-32 x 3 1/2" THD Screw
F	#10-32 x 3/4" PPH Sw ag Screw
G	#6-32x3/8 PPH STL ZN Screw
H	Rubber Feet
I	#6-32x3 3/4 LG PH Screw
J	#10-32 Keput w/Star Washer

6.06 Left Side Internal Component Replacement Parts List

Item #	Qty	Description	Ref #	Catalog #
1	1	INSULATOR, INPUT PCB		See Note 1
2	2	CABLE ASS'Y, 10 CIR RIBBON, 15"LG		9-5922
	3	1 LOGIC/GATE DRIVE PCB ASSEMBLY		9-8010
4	2	ASS'Y, FET HEATSINK		9-8009
		ASSEMBLY, FET HEATSINK PCB		
		DUST COVER, FET ASS'Y		
5	1	FUSE BLOCK		9-5562
6	1	FUSE,0.8A 600V, 13/32" DIA	F1	9-7526
7	1	BUSHING, PLASTIC SNAP, 1 3/8 ID		See Note 1
8	4	STANDOFF, #10-32 X 3/8 HEX X 2"LG, AL		See Note 1
9	1	DIODE BRIDGE ASSY Includes:		9-8011
		DIODE BRIDGE, 3 PHASE W/SCR, 40A, 1600V		
10		THERMAL PAD, Q3, INPUT MODULE		
11	1	ASSEMBLY, INPUT PCB		9-8012
12	1	BRKT, HEATSINK MOUNTING, PM50XL		See Note 1
13	1	HARNESS, INRUSH CONTROL		See Note 1
14	1	HARNESS CAP/BD/VOLTAGE SELECT		See Note 1
15	1	HARNESS VOLTAGE SELECT		See Note 1
16	1	VOLTAGE SELECTION LABEL		See Note 1
17	1	TEMPERATURE SWITCH	TS1	See Note 1

Note 1: Item shown for illustration purposes only.



Note: Illustration may vary slightly from actual unit.

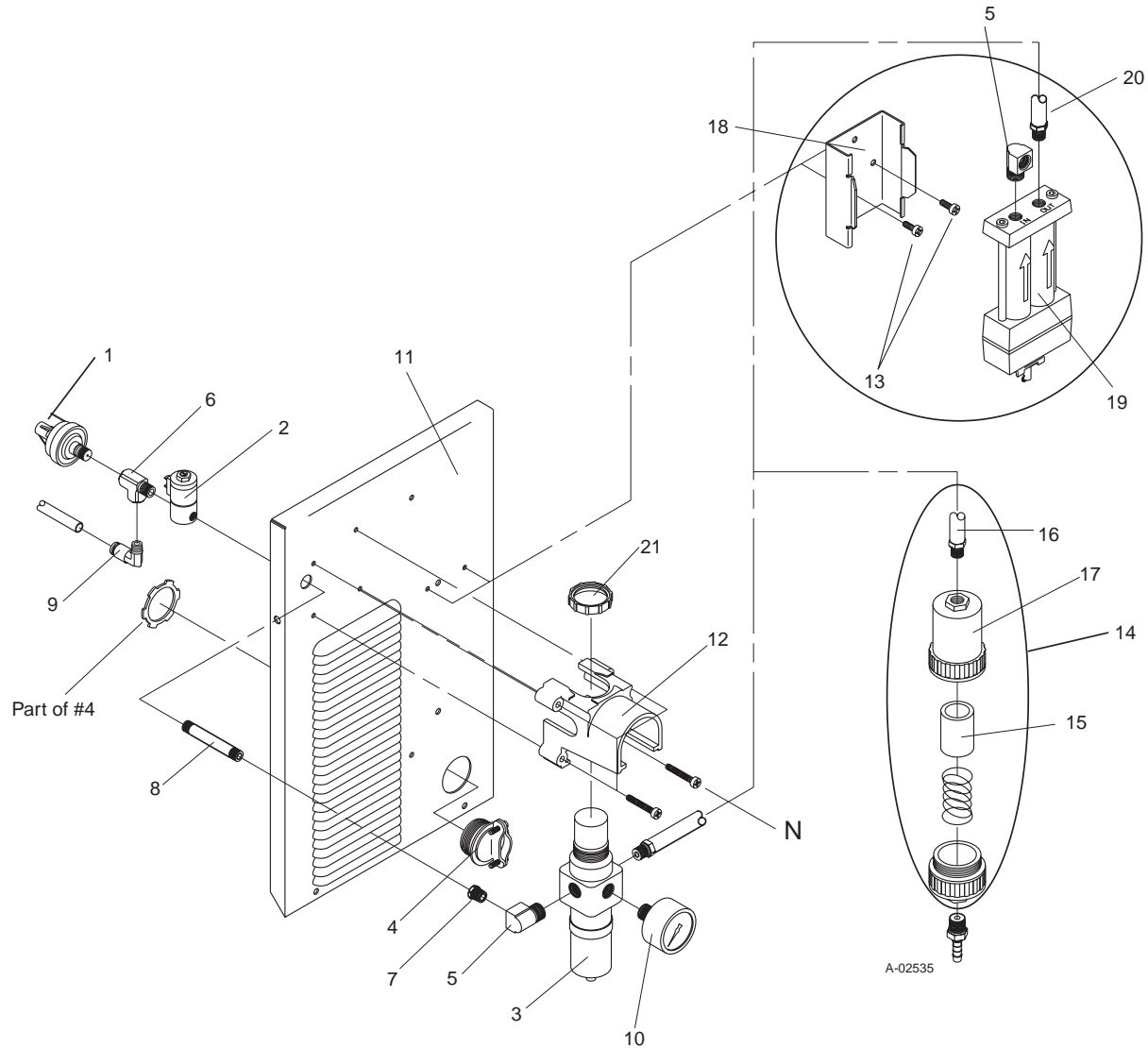
	HARDWARE
A	#10-32 Regular Nylon Lock Nut
B	#10-32 x 2" PPH HDMS
C	#10-32 x 0.5" PPH Sw ageform Stl Zn Screw
D	1/4-20 x 3" Screw , Soc HD
E	#6-32 x 3 1/2" THD Screw
F	#10-32 x 3/4" PPH Sw ag Screw
G	#6-32x3/8 PPH STL ZN Screw
H	Rubber Feet
I	#6-32x3 3/4 LG PH Screw
J	#10-32 Keput w/Star Washer

6.07 Rear Panel Replacement Parts List

Item #	Qty	Description	Ref.	Catalog #
1	1	PRESSURE SWITCH-35 PSI	PS1	9-1044
2	1	VALVE, SOLENOID 1/8 NPT	SOL	8-3370
3	1	REGULATOR, AIR LINE		9-7514
4	1	FLEX CONNECTOR		8-4289
5	1	1/4 NPT STREET ELBOW		9-2184
6	1	1/8 NPT STR.TEE		8-0352
7	1	1/4-1/8 NPT REDUCER		9-2023
8	1	FITTING, 1/8 NPT X 2" LONG NIPPLE, BRASS		9-7524
9	1	FITTING, 1/8 NPT X 1/4 TUBE 90°		9-7525
10	1	PRESSURE GAUGE		9-1045
11	1	PANEL, REAR, Includes: PANEL, REAR LABEL, GAS SUPPLY LABEL INPUT POWER CONNECTIONS		9-8013
12	1	BRACKET, REGULATOR MOUNTING		9-7589
13	2	10-32X.5 PPH FORM STL ZN. PARKER KALON		9-7590
14	1	FILTER KIT "DRY AIR" – INCLUDES FILTER AND HOSE - OPTIONAL		7-7507
15	1	REPLACEMENT FILTER ELEMENT "DRY AIR"		9-7741
16	1	REPLACEMENT FILTER HOSE "DRY AIR"		9-7742
17	1	REPLACEMENT FILTER BODY "DRY AIR"		9-7740
18	1	BRACKET, LAMAN FILTER MOUNTING - OPTIONAL		9-7535
19	1	TWO STAGE AIR LINE FILTER KIT - OPTIONAL DUAL STAGE AIR FILTER ASSEMBLY REPLACEMENT FIRST STAGE FILTER REPLACEMENT SECOND STAGE FILTER		7-7500 9-7527 9-1021 9-1022
20	1	ASSEMBLY, HOSE, FILTER TO REGULATOR		9-7513
21	1	PANEL MOUNTING NUT		9-5804
N/S	1	220V SINGLE PHASE INPUT POWER CABLE (6 ft) (1.8 m)		8-4384

NOTE 1: Item can be purchased locally.

N/S= Not Shown



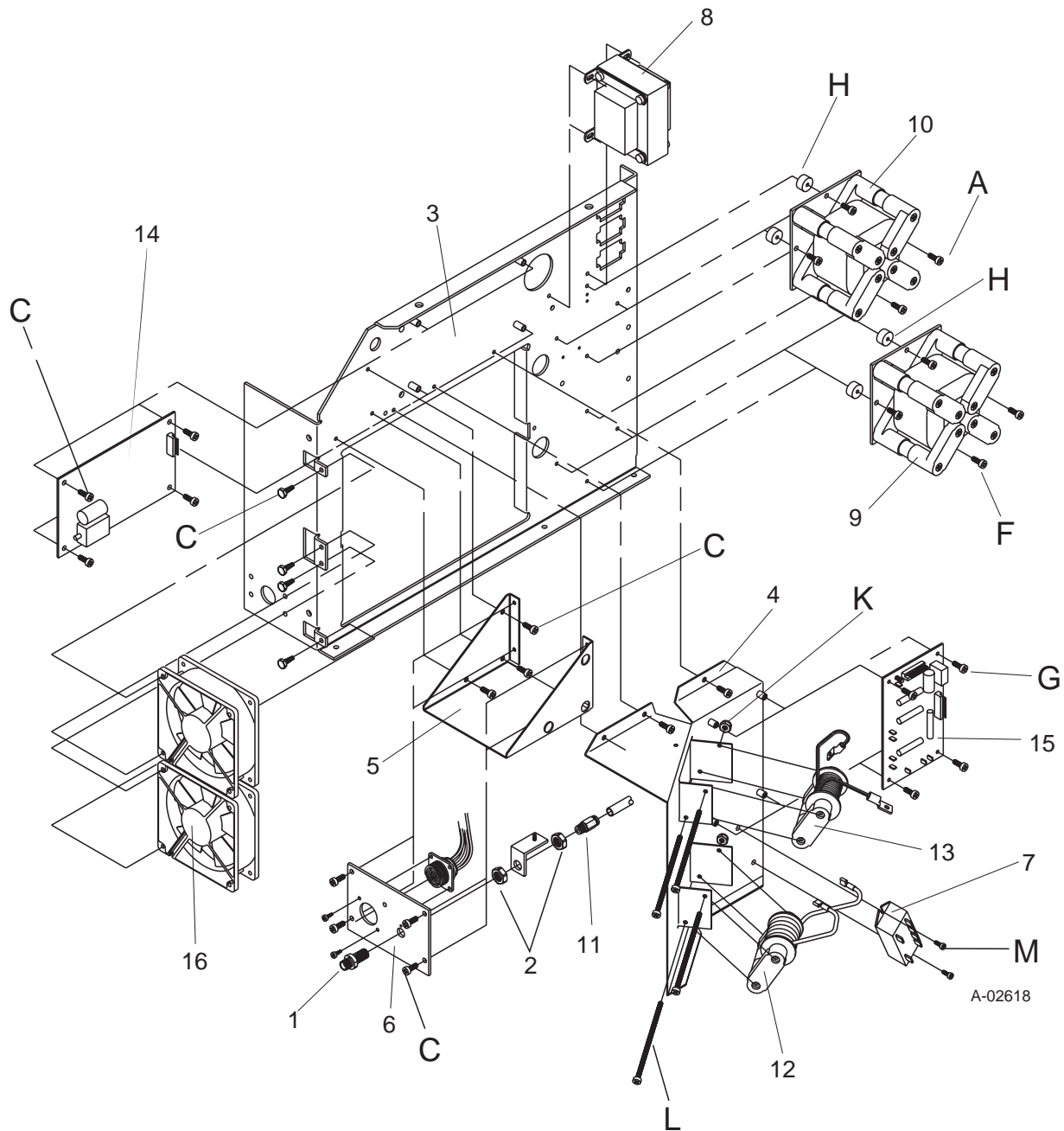
NOTE: Illustration may vary slightly from actual unit.

	HARDWARE
A	#10-32 Regular Nylon Lock Nut
B	#10-32 x 2" PPH HDMS
C	#10-32 x 0.5" PPH Sw ageform Stl Zn Screw
D	1/4-20 x 3" Screw , Soc HD
E	#6-32 x 3 1/2" THD Screw
F	#10-32 x 3/4" PPH Sw ag Screw
G	#6-32x3/8" PPH STL ZN Screw
H	Rubber Feet
I	#6-32x3 3/4" LG PH Screw
J	#10-32 Keput w/Star Washer
K	#6-32 Regular Nylon Lock Nut
L	#6-32X3-3/4"LG, PH Screw
M	#6-20X3/8" PPH THD Screw
N	#10-32x1 1/8" PPH Screw

6.08 Right Side Internal Component Replacement Parts List

Item #	Qty	Description	Ref #.	Catalog #
1	1	BULKHEAD ADAPTER, O2B - 1/8 NPT		9-4045
2	2	9/16-18 JAM NUT, BRASS		8-2149
3	1	CHASSIS, CENTER		See Note 1
4	1	PANEL, PILOT ASS'Y MOUNTING		See Note 1
5	1	BRKT, BULKHEAD MOUNTING		See Note 1
6	1	INSULATOR, BULKHEAD		See Note 1
7	1	PCR RELAY, DPST-NO, 25A @ 250V, 12VDC COIL	PCR	9-7508
8	1	TRANSFORMER, AUX., IEC BOBBIN	T2	9-7541
9	1	ASS'Y, MAIN TRANSFORMER	T1	9-7567
10	1	ASS'Y, OUTPUT INDUCTOR	L1	9-7595
11	2	FITTING, 1/8 NPT X 1/4 TUBE STR		8-3360
12	1	COIL, PILOT INDUCTOR	L2	9-7596
13	1	COIL, CD XFMR, SECONDARY	T3	9-7618
14	1	ASS'Y, CD PCB		9-7517
15	1	ASS'Y, PILOT/OUTPUT PCB		9-7518
16	2	FAN, 115V, 50/60HZ, 95/115CFM W/.187 TABS	M1, M2	8-3209

NOTE 1: Item shown for illustration purposes only.



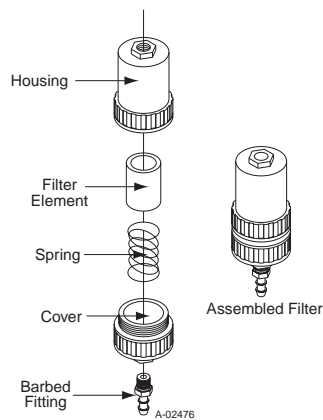
A-02618

NOTE: Illustration may vary slightly from actual unit.

HARDWARE	
A	#10-32 Regular Nylon Lock Nut
B	#10-32 x 2" PPH HDMS
C	#10-32 x 0.5" PPH Sw ageform Stl Zn Screw
D	1/4-20 x 3" Screw , Soc HD
E	#6-32 x 3 1/2" THD Screw
F	#10-32 x 3/4" PPH Sw ag Screw
G	#6-32x3/8" PPH STL ZN Screw
H	Rubber Feet
I	#6-32x3 3/4" LG PH Screw
J	#10-32 Keput w/Star Washer
K	#6-32 Regular Nylon Lock Nut
L	#6-32X3-3/4"LG, PH Screw
M	#6-20X3/8" PPH THD Screw

6.09 Options and Accessories

Qty	Description	Catalog #
1	SMART CART	7-7777
1	575V TRANSFORMER	9-7500
1	CUTTING GUIDE KIT	7-8910
1	FILTER KIT "DRY AIR" – INCLUDES FILTER AND HOSE - OPTIONAL	7-7507
1	REPLACEMENT FILTER BODY "DRY AIR"	9-7740
1	REPLACEMENT FILTER ELEMENT "DRY AIR"	9-7741
1	REPLACEMENT FILTER HOSE "DRY AIR"	9-7742
1	BRACKET, LAMAN FILTER MOUNTING - OPTIONAL	9-7535
1	TWO STAGE AIR LINE FILTER KIT - OPTIONAL	7-7500
1	DUAL STAGE AIR FILTER ASSEMBLY	9-7527
1	REPLACEMENT FIRST STAGE FILTER	9-1021
1	REPLACEMENT SECOND STAGE FILTER	9-1022
	COMPUTER CONTROL CABLE (CNC)	
1	25 FOOT (7.6 m)	8-5557
1	50 FOOT (15.2 m)	8-5558
1	HAND PENDANT CONTROL WITH 25 ft. (15.2 m) CABLE	7-3114
1	HAND PENDANT EXTENSION CABLE - 25 ft. (15.2 m)	7-7744
1	METAL MOUNTING TUBE WITH PINION ASSEMBLY	7-7745



APPENDIX I: INPUT WIRING REQUIREMENTS

Input		Power Input		Current		Suggested Sizes (See Notes)					
Voltage	Freq.	1-Ph	3-Ph	1-Ph	3-Ph	Fuse (Amps)		Wire (AWG)		Wire (Canada)	
(Volts)	(Hz)	(kVA)	(kVA)	(Amps)	(Amps)	1-Ph	3-Ph	1-Ph	3-Ph	1-Ph	3-Ph
208	50/60	8.2	7.2	39.6	20	45	25	8	10	8	10
230	50/60	8.2	7.2	35.6	18	45	25	8	10	8	10
240	50/60	8.3	7.3	34.4	17.5	45	25	8	10	8	10
380	50/60	9.9	8.6	26	13	30	20	10	14	10	14
415	50/60	9.9	8.6	23.8	12	30	20	10	14	10	14
460	50/60	9.9	8.8	21.5	11	25	20	10	14	10	14
575	Requires Transformer Module										
Line Voltages with Suggested Circuit Protection and Wire Sizes Based on National Electric Code and Canadian Electrical Code											

NOTES

Refer to Local and National Codes or local authority having jurisdiction for proper wiring requirements.

Cable size is de-rated based on the Duty Cycle of the equipment.

The suggested sizes are based on flexible power cable with power plug installations. For hard-wired installations refer to local or national codes.

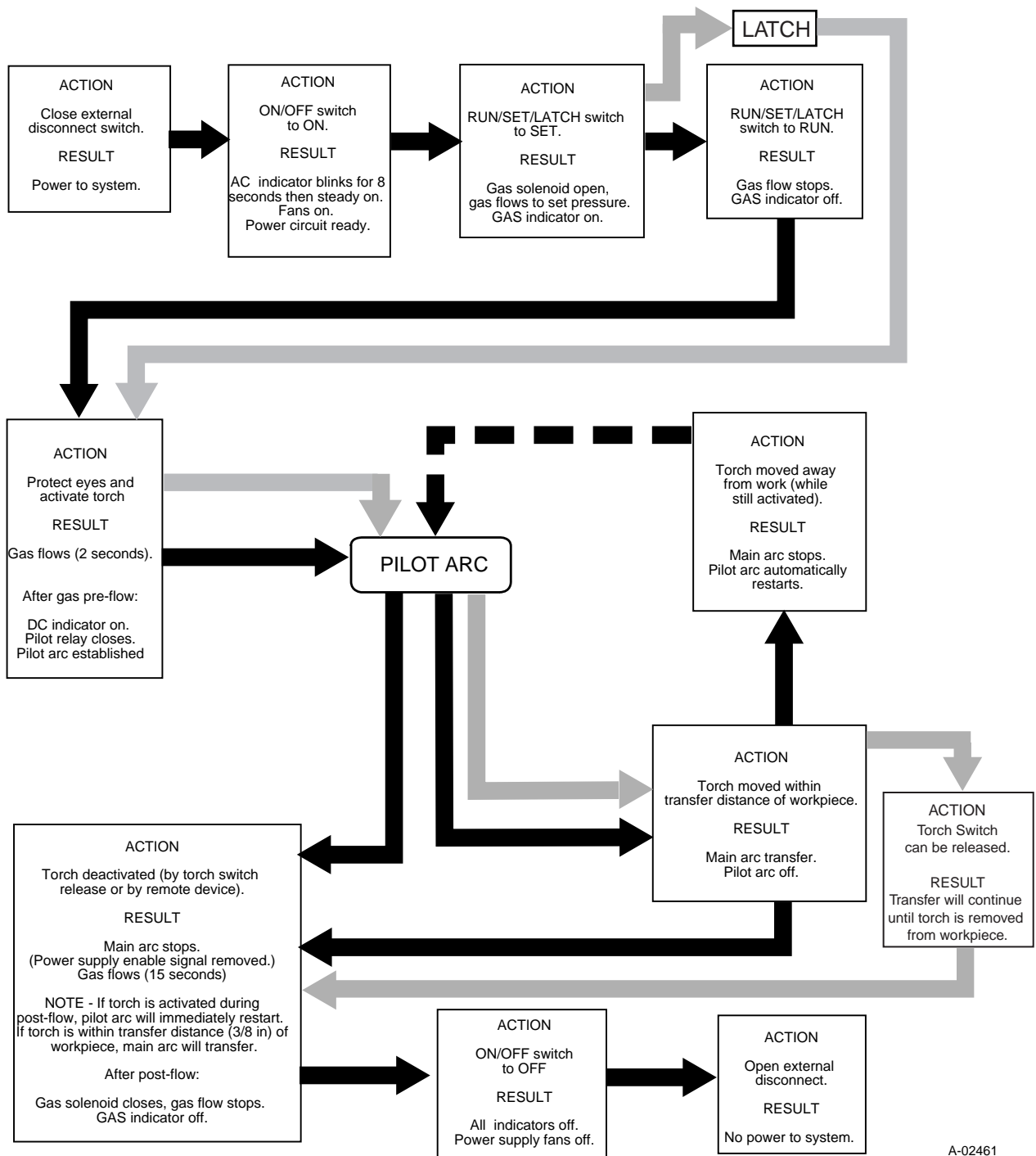
Cable conductor temperature used is 167° F (75° C).

An energy limiting fuse UL Class RK-1 (examples: BUSS LPS/LPN-RK or Gould-Shawmut AZK-A6K) should be used to minimize damage to Plasma Cutting, Welding or power distribution equipment.

NEVER use replaceable element fuses like UL Class H, or "one-time" fuses like UL Class K5.

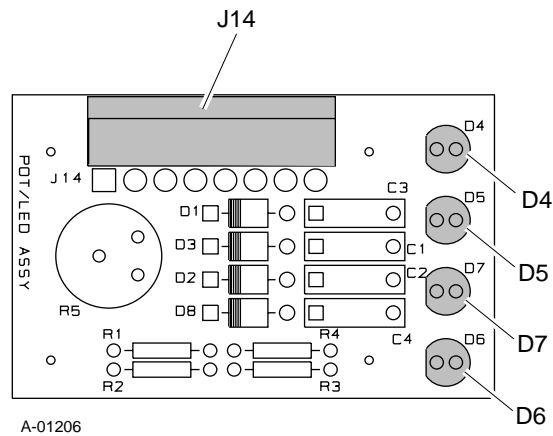
Flexible cable must have an outside diameter of 0.69 inches (17.5 mm) or greater.

APPENDIX II: SEQUENCE OF OPERATION (BLOCK DIAGRAM)



A-02461

APPENDIX III: POT/LED PC BOARD LAYOUT

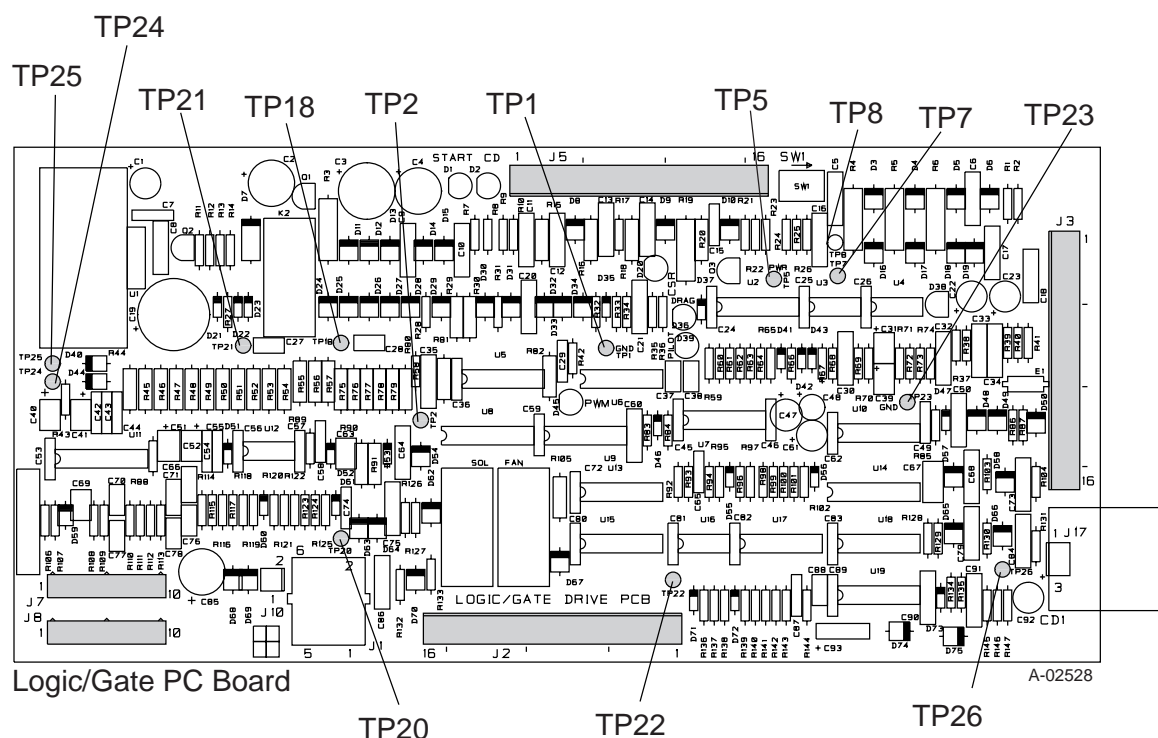


Pot/LED PC Board Signals

- J14-1 +10 vdc from Logic PC Board (J3-7)
- J14-2 Current Control to Logic PC Board (J3-8)
- J14-3 Return for Current Control from Logic PC Board (J3-9)
- J14-4 18VDC Unregulated VDC from Logic PC Board (J3-10)**
- J14-5 Logic Low Signal for AC OK Indicator to Logic PC Board (J3-11)
- J14-6 Logic Low Signal for GAS Indicator to Logic PC Board (J3-12)
- J14-7 Logic Low Signal for TEMP Indicator to Logic PC Board (J3-13)
- J14-8 Logic Low Signal for DC Indicator to Logic PC Board (J3-14)

- D4 Front Panel AC Indicator
- D5 Front Panel TEMP Indicator
- D6 Front Panel DC Indicator
- D7 Front Panel GAS Indicator

APPENDIX IV: LOGIC/GATE PC BOARD LAYOUT

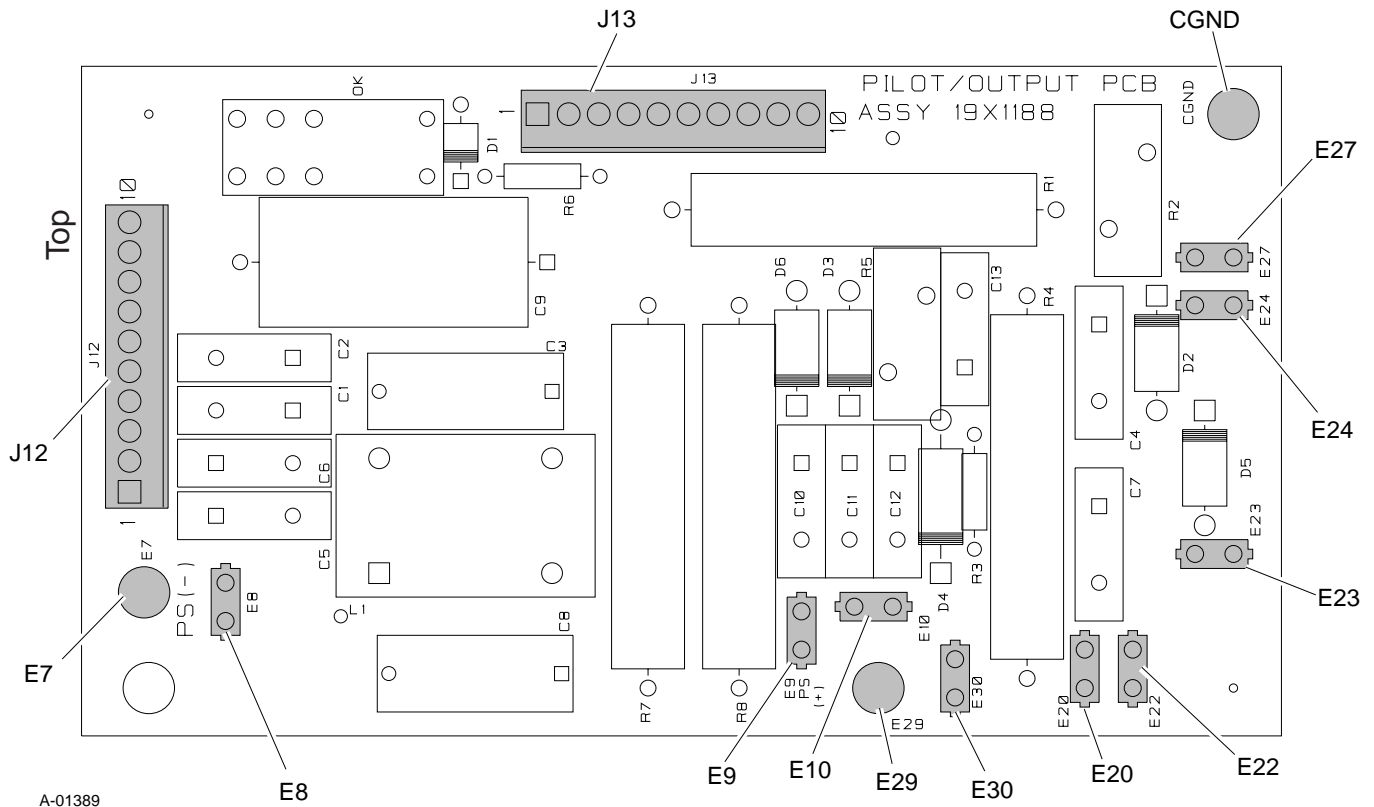


Logic/Gate PC Board Signals

- J1-1 36 VAC from Auxiliary Transformer
- J1-2 115 VAC from Auxiliary Transformer
- J1-3 Center Tap from Auxiliary Transformer (36VAC)
- J1-4 Not Used
- J1-5 36 VAC from Auxiliary Transformer
- J1-6 115 VAC Return from Auxiliary Transformer
- J2-1 115 VAC Return to K10 Relay/Contactor MC1
- J2-2 115 VAC Return to Fan #1
- J2-3 115 VAC Return to Fan #2
- J2-4 115 VAC Return to Solenoid
- J2-5 Not Used
- J2-6 Not Used
- J2-7 115 VAC to K10 Relay/MC1 Contactor
- J2-8 115 VAC to Fan #1
- J2-9 115 VAC to Fan #2
- J2-10 115 VAC to Solenoid
- J2-11 Not Used
- J2-12 Not Used
- J2-13 Logic Low Pressure Switch Signal
- J2-14 Return from Pressure Switch
- J2-15 Logic Low Over Temperature Switch on Input Bridge
- J2-16 Over Temperature Switch Return

J3-1	36 VAC to ON/OFF Switch	
J3-2	36 VAC from ON/OFF Switch to Logic/Gate PC Board	
J3-3	36 VAC to ON/OFF Switch	
J3-4	36 VAC from ON/OFF Switch to Logic/Gate PC Board	
J3-5	Logic Low - From RUN/SET/LATCH Switch on Front Panel (RUN)	
J3-6	PCB Common	
J3-7	+10 vdc to Front Panel Current Control Pot J14-1	
J3-8	From Front Panel Current Control Pot Wiper J14-2	
J3-9	To Current Control Pot J14-3 (Return)	
J3-10	Unregulated +18 VDC to Front Panel (J14-4)	
J3-11	Logic Low for AC Indicator on Front Panel (J14-5)	
J3-12	Logic Low for GAS Indicator on Front Panel (J14-6)	
J3-13	Logic Low for TEMP Indicator on Front Panel (J14-7)	
J3-14	Logic Low for DC Indicator on Front Panel (J14-8)	
J3-15	Not Used	
J3-16	Logic Low - From RUN/SET/LATCH Switch on Front Panel (LATCH)	
J5-1	36 VAC to CD PC Board (J11-1)	
J5-2	36VAC Centertap to CD PC Board (J11-2)	
J5-3	36 VAC to CD PC Board (J11-3)	
J5-4	Logic Low CD Enable Signal to CD PC Board (J11-4)	
J5-5	CD Enable Return to CD PC Board (J11-5)	
J5-6	Unregulated +18 vdc to PCR Relay	
J5-7	Logic Low PCR Signal to PCR Relay	
J5-8	Logic Low Torch Switch Input from Pilot/Output PCB (J13-1)	
J5-9	Torch Switch Return to Pilot/Output PC Board (J13-2)	
J5-10	Logic Low - OK-To-Move Signal to Pilot/Output PC Board (J13-3)	
J5-11	Unregulated +18 VDC for OK-To-Move (CSR) Relay on Pilot/Output PC Board (J13-4)	
J5-12	PS + from Pilot/Output PCB to sense Positive Output Voltage	
J5-13	Not Used	
J5-14	From Pilot/Output PC Board to Sense Drag Cutting (Tip)	
J5-15	Not Used	
J5-16	PS - From Pilot/Output PC Board to Sense negative DC Output Voltage	
J10-1	Logic Low - MC1 Contactor to Input PC Board (J16-1)	
J10-2	Unregulated +18 VDC to Input PC Board for K11 Relay on Input PCB	
J17-1	Logic Low - CSR Signal from Current Sensor	
J17-2	Return for CSR Signal	
J17-3	+12 VDC to Current Sensor	
LED Description		
TP1	Logic Ground	D1 Start
TP2	Unregulated +18 VDC	D2 CD Enable
TP3	Unregulated +18 VDC	D20 CSR
TP4	Not Used	D36 Drag On
TP5	+12 VDC	D39 Pilot
TP6	+12 VDC	D45 PWM Enabled
TP7	Drag Circuit Disable (jumper to TP1)	
TP8	Negative Voltage Sensing - jumper to TP1 to override	
TP20	Logic Low Primary Overcurrent Shutdown (momentary)	
TP26	Logic Low CSR input	
TP22	Current Demand Signal	
TP25	Gate Drive Signal A	
TP24	Gate Drive Signal B	

APPENDIX V: PILOT OUTPUT PC BOARD LAYOUT



Pilot Output PC Board Signals

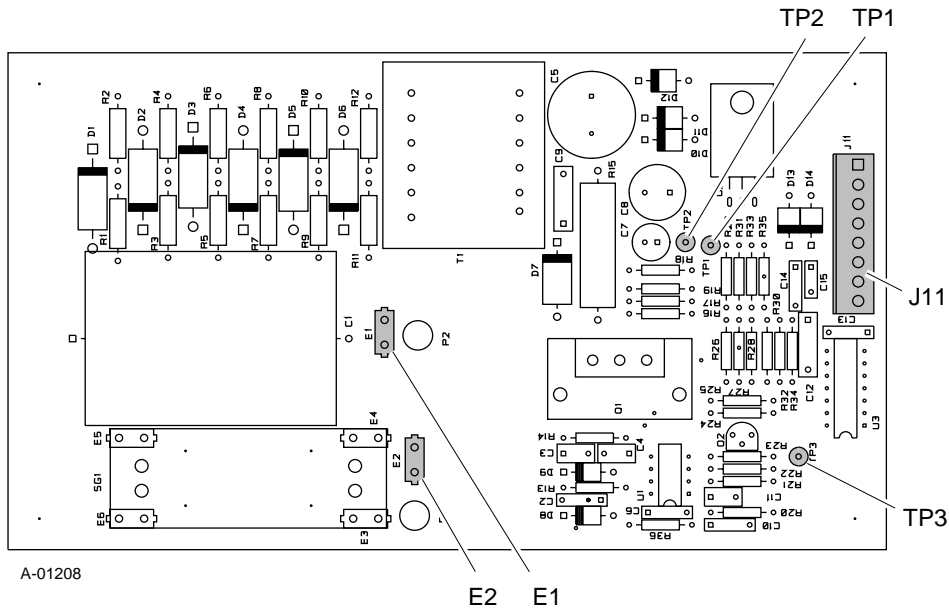
- J12-1 Torch Switch Filter in from J22-3 Torch Control
- J12-2 Not Used
- J12-3 Torch Switch Filter Return from J22-4 Torch Control
- J12-4 Not Used
- J12-5 Pilot Return Shield to J22-1 Torch Control
- J12-6 Torch Switch Shield to J22-2 Torch Control
- J12-7 Not Used
- J12-8 OK to Move TO J22-12
- J12-9 Not Used
- J12-10 OK to Move RTN TO J22-14 Torch Control

- J13-1 Torch Switch Filter out to J5-8 Logic Board Torch Sw
- J13-2 Torch Switch Filter Return out to J5-9 Logic Board Torch Sw Return
- J13-3 Logic Low OK to Move Relay Coil to Logic PCB J5-10 OK to Move
- J13-4 OK to Move Relay Coil to Logic PCB J5-11 +Unregulated 18VDC
- J13-5 PS(+) to Logic Board J5-12 Output Sense Gnd
- J13-6 Not Used
- J13-7 Tip Voltage Sense to Logic Board J5-14 Drag Sense
- J13-8 Not Used
- J13-9 PS(-) Sense to Logic Board J5-16 PS(-) Sense (DC and Off the Plate)
- J13-10 Not Used

CGND Chassis Gnd

- E7 PS(-) C4 Rtn for Pilot Voltage Twisted with Pilot RTN to E23
- E8 PS(-) (Stud) from Output Inductor L1 to CD Xfmr
- E9 PS(+) to E18 Upper Fet Module
- E10 PS(+) to E18 Upper Fet Module
- E20 From E22 to PCR Pin 2
- E22 From Pilot Choke to E20
- E23 C4 Rtn for Pilot Voltage Twisted with Pilot RTN from E7
- E24 Pilot RTN from Standoff on bulk head and Torch Cable
- E27 Pilot RTN to Pilot Choke
- E29 PS(+) (Stud) from Work lead Through Current Sense To E18 Fet Modules
- E30 PS(+) to CSR 8

APPENDIX VI: CD PC BOARD LAYOUT



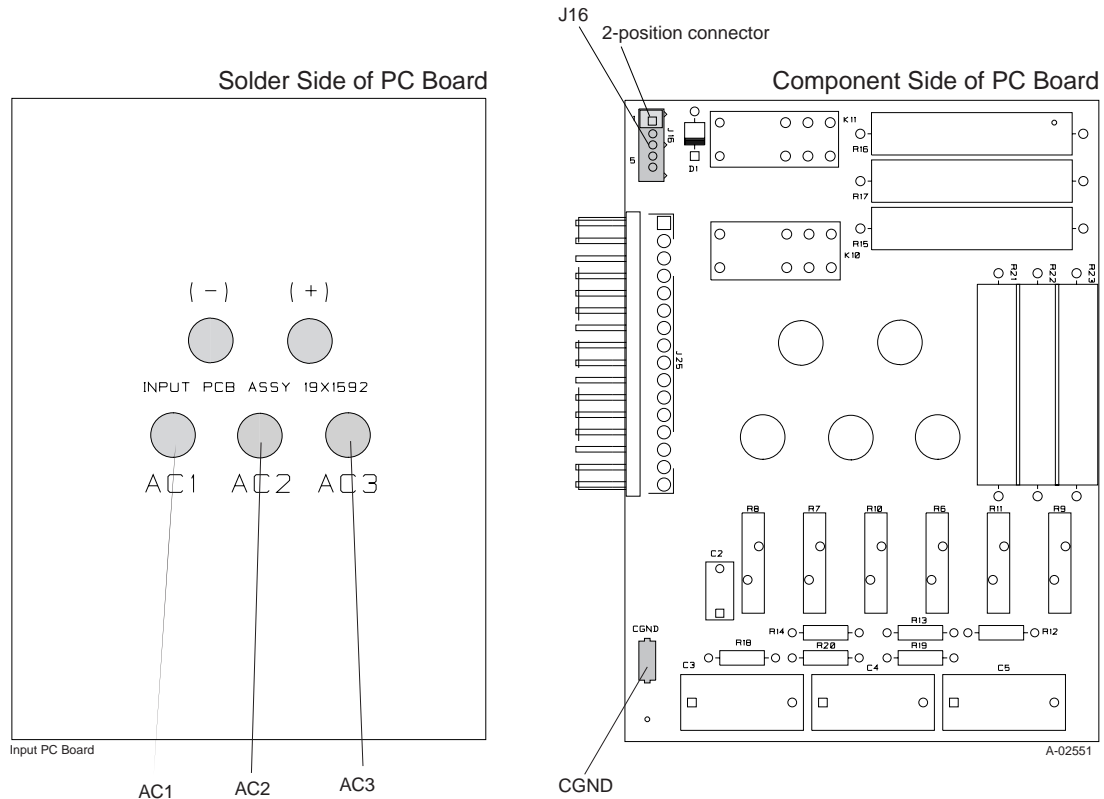
CD PC Board Signals

J11-1	36 VAC from Logic PC Board (J5-1)
J11-2	Return from Logic PC Board (J5-2) 36VAC centertap
J11-3	36 VAC from Logic PC Board (J5-3)
J11-4	Logic Low CD Enable Signal from Logic PC Board (J5-4)
J11-5	Return for CD Enable Signal from Logic PC Board (J5-5)
J11-6	Not Used
J11-7	Not Used
J11-8	Not Used

TP1	Logic Ground or Return
TP2	+12 VDC
TP3	Not Used

E1	CD output
E2	CD Output

APPENDIX VII: INPUT PC BOARD LAYOUT



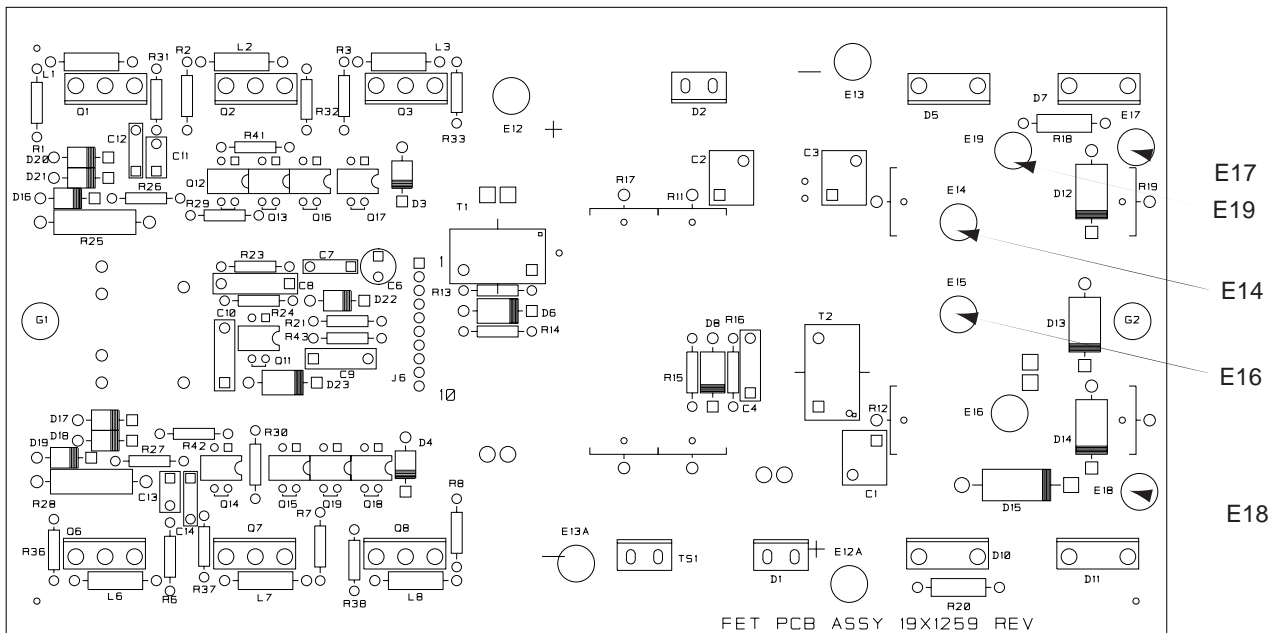
Input PC Board Signals

- J16-1 Logic low inrush signal from Logic PCB J10-1
- J16-2 Unregulated +18VDC to inrush Relay K11
- J16-3 Not used
- J16-4 Not used
- J16-5 Not used

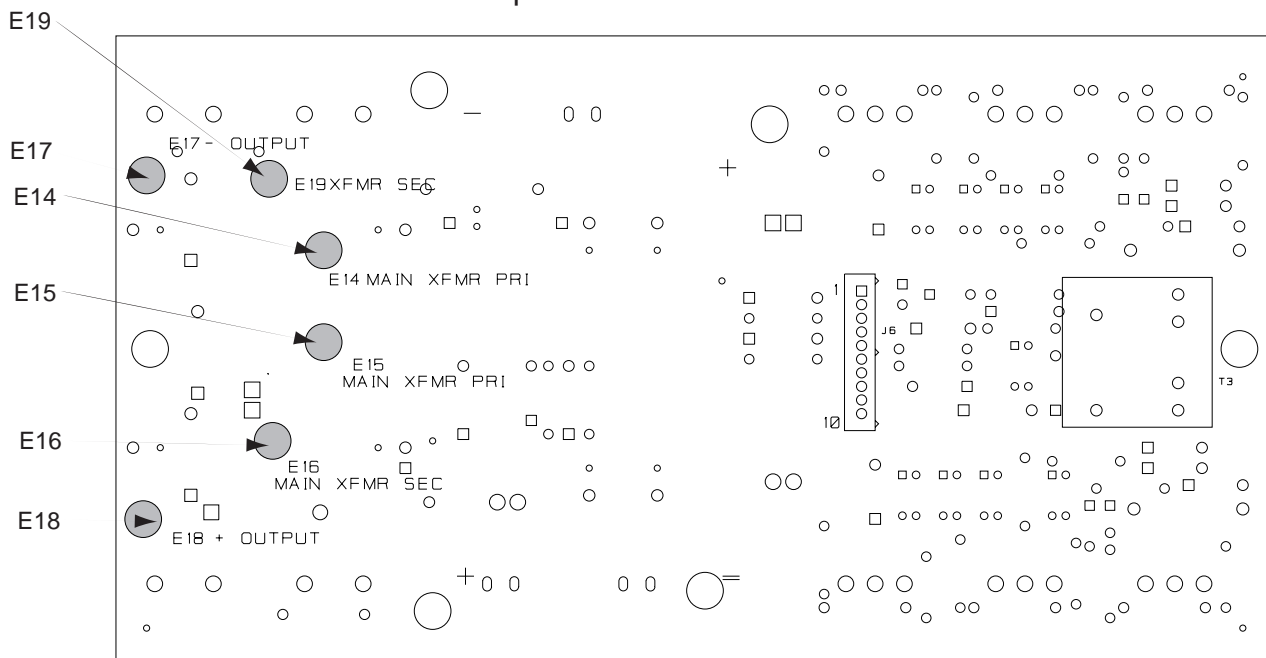
CGND Chassis Ground to Chassis Ground

- (+) (+) Output to the Cap Board (+) E25
- (-) Rectifier (-) Module (-) Output to the Cap Board (-) E26
- AC1 AC Input Phase 1 from the contactor T1 and T4
- AC2 AC Input Phase 2 from the contactor T2
- AC3 AC Input Phase 3 from the contactor T3

APPENDIX VIII: FET PC BOARD LAYOUT



Component Side of PC Board



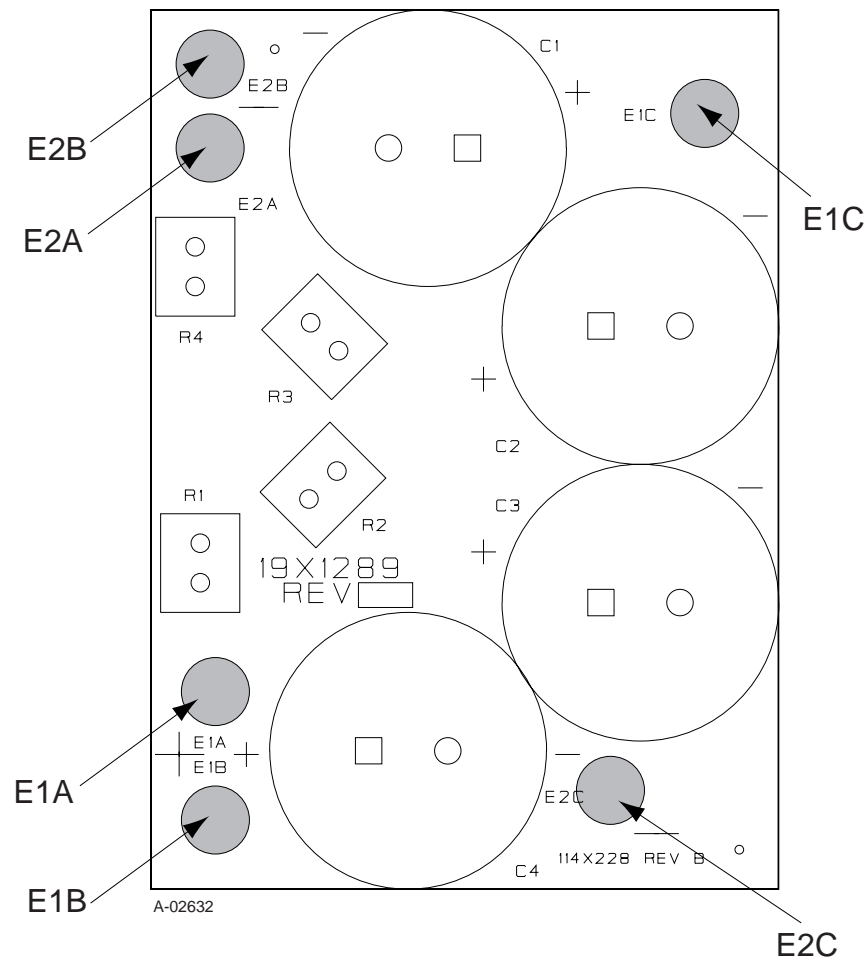
Solder Side of PC Board

A-02631

FET PC Board Signals (Upper and Lower Assemblies)

J6-1	+12VDC from Logic/Gate PCB, upper J7-1, lower J8-1
J6-2	PCB common, GND, from Logic Gate PCB, upper J7-2, lower J8-1
J6-3	Pwm Output from the Logic/Gate Board upper J7-3 Lower J8-3
J6-4	Pwm Output RTN J6-2 from the Logic/Gate Board upper J7-4 Lower J8-4
J6-5	PRI CURRENT SENSE to the Logic/Gate Board upper J7-5 Lower J8-5
J6-6	PRI CURRENT SENSE RTN to the Logic/Gate Board upper J7-6 Lower J8-6
J6-7	SEC CURRENT SENSE to the Logic/Gate Board upper J7-7 Lower J8-7
J6-8	SEC CURRENT SENSE RTN to the Logic/Gate Board upper J7-8 Lower J8-8
J6-9	OVER TEMP RTN to the Logic/Gate Board upper J7-9 Lower J8-9
J6-10	Logic Low OVER TEMP to the Logic/Gate Board upper J7-10 Lower J8-10
E14	MAIN XFMR PRI to MAIN XFMR PRI E14
E15	MAIN XFMR PRI to MAIN XFMR PRI E15
E16	MAIN XFMR SEC from MAIN XFMR SEC E16
E17	OUTPUT (-) to OUTPUT INDUCTOR L1
E18	OUTPUT (+) to Current Sense Transformer, E9 on Output Board, and pin 8 PCR
E19	MAIN XFMR SEC from MAIN XFMR SEC E19
G1	HEATSINK GND To HEAT SINK
G2	HEATSINK GND To HEAT SINK

APPENDIX IX: CAPACITOR PC BOARD LAYOUT



Capacitor PC Board Signals

E1B	Positive Rail to FET Board
E1C	Positive Rail to FET Board
E2B	Negative Rail to FET Board
E2C	Negative Rail to FET Board
E1A	Positive Input from Input Board (+)
E2A	Negative Input from Input Board (-) Rectifier (-)

Manual 0-2745

Manual 0-2745

